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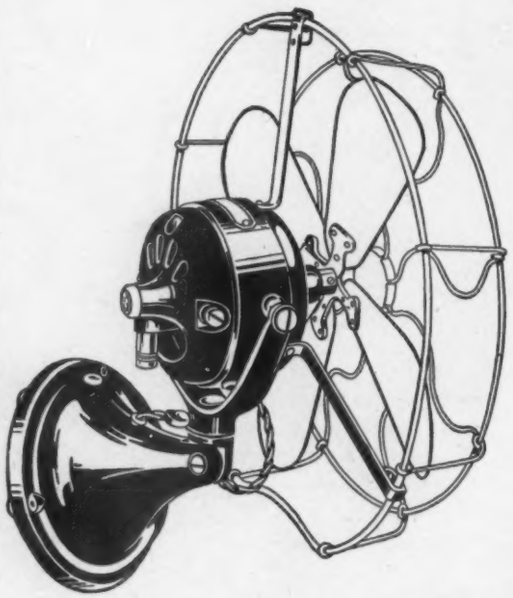

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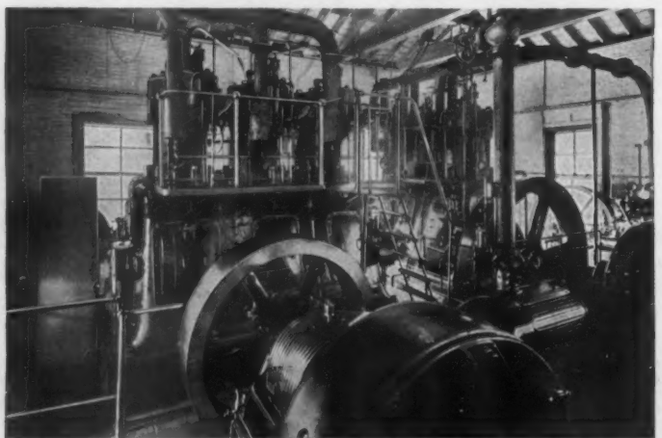

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ESSENTIALS OF A MODERN DISTRIBUTING SYSTEM

BY R. E. CUNNINGHAM

(Descriptive comment is here given regarding the distribution system of the Southern California Edison Company, this paper having been presented before the February 16, 1915, meeting of the Los Angeles Secetion of the American Institute of Electrical Engineers. Mr. Cunningham is superintendent of electric distribution for the company whose system he describes.—The Editor.)

The casual observer inspecting the property of an electric light and power company finds little of interest in the distribution system. It has none of the spectacular features of the high voltage transmission system or the generating plant with the high head water wheel or mammoth high pressure steam turbine. Our observer gladly follows his guide through the spacious power house and will spend hours to master the workings of a special piece of apparatus which is said to increase the economy of the plant by a fraction of a mill per kw.hr. or he will spend days following a long span steel tower transmission line over mountains and valleys to its terminus in the main substation.

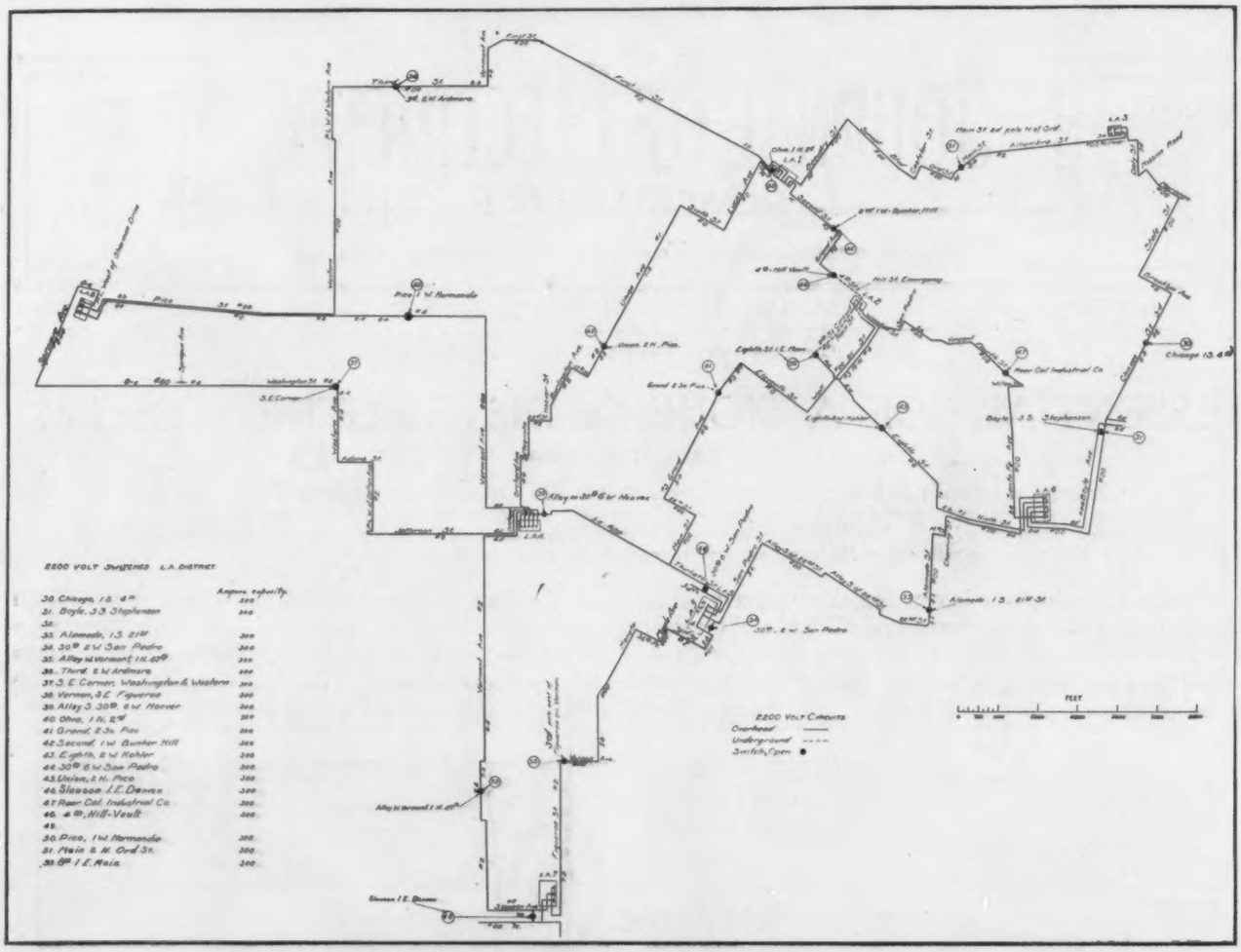
Notice his interest wane when he is shown the beginning of the distribution system, where low voltage cables disappear through the floor or a hole in the wall on their way to the customer by way of the conduits hidden under the streets or the pole lines down the alleys and rear property lines.

The fact that the distribution system of the Southern California Edison Company represents forty-three per cent of the total capital investment makes it necessary for special attention to be given to the seemingly uninteresting details of distribution.

"Before and After" Illustration of Joint Poles in Los Angeles.

An electric distribution system to be "down to date" must have the following essentials: reliable service, good regulation, safe construction (both for the public as well as the employes who must work on the lines), efficient operation, these results to be accomplished with a minimum expenditure. The purpose of this paper is to show in a general way how the attempt has been made to accomplish these results for the Southern California Edison Company's system.

Without explaining why certain voltages have been selected for distribution purposes, we will state that 2200 volt, three phase and single phase is used on primary circuits for city distribution; 10,000 or 15,000 volts for rural districts and larger power loads, with


2200 VOLT SWITCHES L.A. DISTRICT
Ampere capacity
30. Chicago, 1.8. 4th 300
31. Boyle, 3.3. Stephenson 300
32.
33. Alameda, 1.S. 21st 300
34. 30th E.W. San Pedro 300
35. Alley N. Vernon 1.H. 61st 300
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37. S.E. Corner, Washington & Western 300
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39. Alley S. 30th E.W. Hoover 300
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41. Grand, E.3d. Pico 300
42. Second, 1.W. Bunker Hill 300
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47. Rear Cal. Industrial Co. 300
48. 4th, Hill-Vault 300
49.
50. Pico, 1.W. Normandie 300
51. Main S.N. Ord St. 300
52. 6th E. Main 300
2200 Volt Circuits
Overhead
Underground
Switch, Open
FEET

Layout of Eight 2200-Volt Distributing Substation in Los Angeles.

110-220 volts, three wire for a.c. secondaries and d.c. distribution. Only these voltages will be considered.

We have stated that the first essential of a "down to date" system is reliable service, and will assume that the lines have been constructed in a secure manner; it then becomes necessary to so arrange circuits that we may provide emergency service in case of trouble in substations, or trouble on the transmission lines to substations.

The Los Angeles system illustrates how this has been accomplished for the 2200 volt system. The accompanying drawing, No. 6204, shows the relative locations of the eight substations from which current is distributed to the city of Los Angeles. These substations, with the exception of Los Angeles No. 8, have two or more 15,000 volt supply lines furnishing power to them. In all cases these lines are brought to the substations over separate routes so that it would seem ample precaution has been provided against failure of the power supply to the substation.

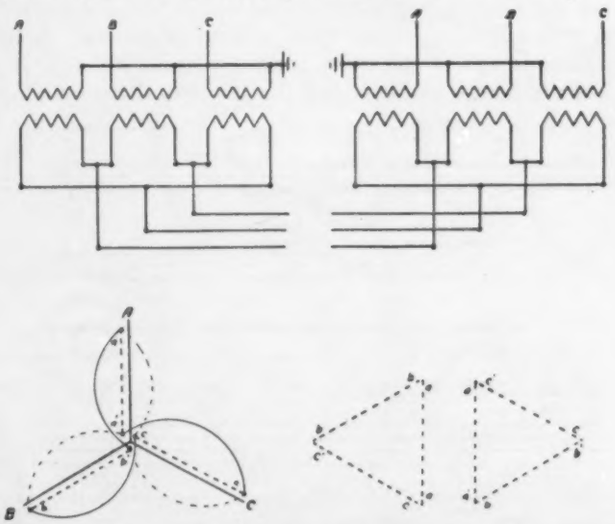
There have been numerous occasions where it has been necessary to shut down substations to make changes in transformers, switchboards or other apparatus; also there have been unforseen accidents in substations causing burnouts in certain apparatus, so that further precaution is necessary to take care of these conditions. This has been accomplished by a system of 2200 volt tie lines between substations. These lines under ordinary conditions serve as main feeders for distribution purposes. In most cases the tie switch is approximately midway between adjacent substations. Normally these switches are left open. In case of trouble at any substation or in case it is desired to shut down any substation on account of making changes or replacing apparatus, the switches on tie lines connected with the particular substation in question may be closed and circuits operated in parallel. If the load to be supplied exceeds the capacity of regulators on the circuits in question, throw-over switches are provided in each station so that the regulators can be disconnected and the circuits supplied directly from the substation bus. With this arrangement the regulation will depend on the general system voltage, but the object of maintaining service is accomplished.

To further assist in maintaining service a portable substation has been arranged for. This substation is mounted on a heavy truck and contains a 525 kw. air blast, three-phase transformer equipped with regulator head on the 2200 volt winding. Disconnecting switches are mounted on the outside of the structure to control the high tension wires before same enter the substation. Within the substation is a one-panel switchboard containing an automatic oil switch and necessary meters for controlling the 2200 volt service. This truck can be drawn by horses or motor truck. It is a quick matter to connect up the high tension wires and

the low tension wires and the substation is ready for service. This portable substation has proved to be a valuable arrangement on numerous occasions.

Portable Substation.

Transformers in all substations are of the same voltage and ratio. The 15,000 volt supply lines and 2200 volt distributing lines have all been tested out and so arranged that all substations can be operated in parallel. The transformers are connected in "Y" for 15,000 volts and in "delta" for 2200 volts. In phasing out the various substations it was necessary to exercise care to see that all transformers were connected in the same manner. It is possible in a Y-delta transformation to obtain what is popularly termed a right or left hand connection on the high tension side of the transformers, producing deltas which will not parallel; or transformer banks having reverse polarities connected in the same manner will give the same results. This condition is shown graphically in the accompanying diagram. When transformer banks were discovered which would not parallel it was necessary to either change the connections on the high tension side of one of the transformer banks or to make up the delta in a different manner.



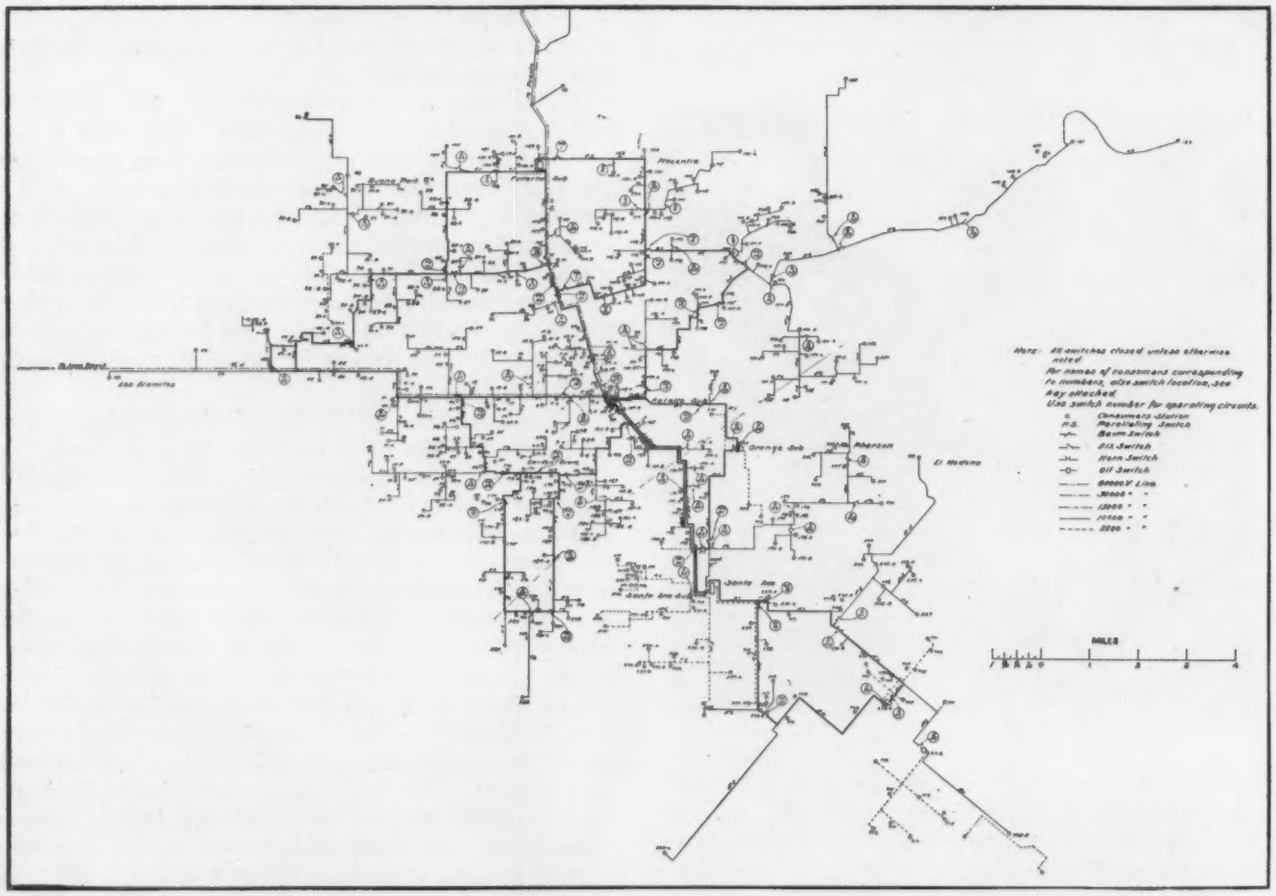
Transformer Connections.

This same general arrangement as described above is being carried out in the other cities on the 2200 volt distribution lines, although there is no place where there is more than two substations outside of Los Angeles in the same district. In cases where there is only one substation, ties are being provided between the various circuits so that in case of serious fire or other accidents in certain portions of town, the portion of the circuits in that district can be isolated and the balance of the circuit can be supplied from one of the other circuits.

In considering the 10,000 volt distributing system, we have much the same problems to meet as with the 2200 volt city distribution, and in addition we have the difficulty that it is unsafe for the linemen to attempt to make connections or to do any work on the lines while they are energized. For this reason we have not only carried out the practice of arranging for tie lines between substations, but also have, wherever possible, arranged for local loop circuits so that with sectionalizing switches it is possible to isolate small sections of the territory without interrupting service to the balance of the district. This feature is shown in the drawing of the arrangement of 10,000volt circuit in the Santa Ana district. The loop circuits are shown by heavy lines that they may be readily distinguished. In most cases these loops have been formed by taking advantage of the line extensions brought about in the usual course of construction required by various extensions. It will be noted that in numerous locations, opportunities will present themselves for providing other loops as future business may arise requiring further extension of lines or in some cases it will be advisable to provide a loop by extending a line for this particular purpose only, as the advantage to be gained in continuous service will more than offset the actual cost involved in connecting up the loop.

It may be interesting to know that only about six miles separate the 10,000 volt lines of the Redlands and Pomona Districts and about four miles separate the system of Whittier and Long Beach Districts. When these gaps have been closed, a 10,000 volt bus line can be provided from the Long Beach steam plant to the easterly limits of Redlands District, a distance of approximately eighty-five miles, supplied from the various substations on the 60,000 volt system. With these various substations and connecting 10,000 volt lines properly phased out, we can duplicate the conditions which have already been obtained on the Los Angeles 2200 volt system for the 10,000 volt systems of the whole valley.

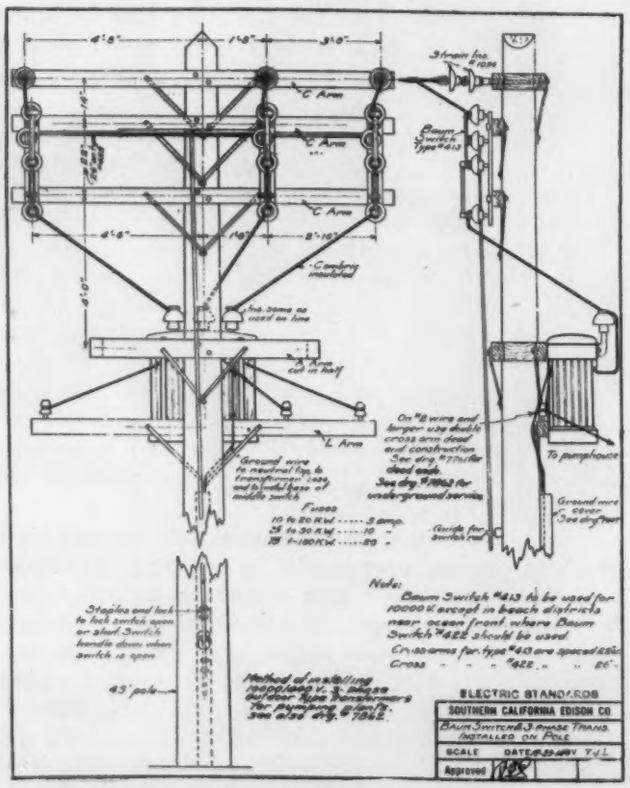
On the 2200 volt lines the triple pole top oil switch has been used for a sectionalizing switch; on the 10,000 volt lines three single pole disconnect switches have been used in most cases. We find, however, that these single pole switches are not satisfactory on important lines and have been trying out a new type of switch recently placed on the market by the Pacific Electric Manufacturing Company, known as Type 1400. It is a triple pole switch controlled by an operating lever at the base of the pole and is very convenient to install,



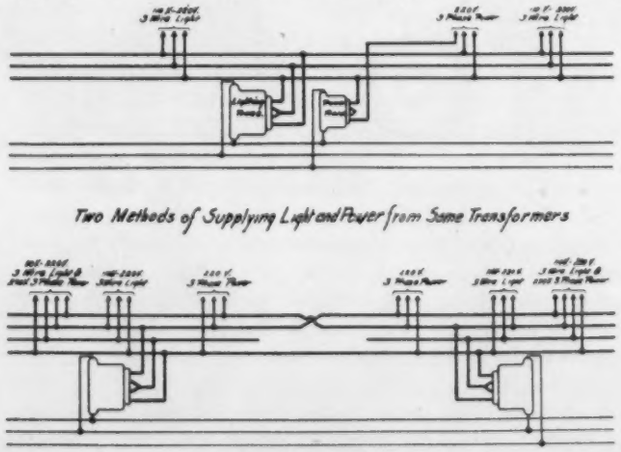
Layout of 10,000-Volt Circuits in Santa Ana District.

as it can be mounted on a single cross arm and requires no insulators other than those which go to make up the switch. Considering the requirements of General Order No. 39, which makes it necessary to test lines by sectionalization in case of trouble, we recommend that this type of switch be installed quite generally on all important lines where now we have the single pole type.

With the early systems of distribution, the matter of close voltage regulation received only slight attention. The simple two wire system seemed to fulfill all requirements as the distance over which the power was distributed were not of any extent; later, the two wire system was superseded by the three-phase, primary system, using three wire 110-220 volt for secondary distribution. The "tree" system or primary distribution is one of the most common forms but unless a large amount is expended for copper, the regulation


C Arm
Strain Ins. #1036
Baum Switch Type #413
Ground wire to neutral lug, to transformer case and to bind base of middle switch
To #2 wire and larger use double cross arm dead end construction
To pumphouse
Ground wire over
Guide for switch rod
Staples and lock to bolt switch open or shut. Switch handle down when switch is open
45' pole
Note:
Baum Switch #413 to be used for 10000 V. except in beach districts near ocean front where Baum Switch #422 should be used.
ELECTRIC STANDARDS
SOUTHERN CALIFORNIA EDISON CO
BAUM SWITCH & 3 PHASE TRANS. INSTALLED ON POLE

Triple Pole Sectionalizing Switch.



Two Methods of Supplying Light and Power from Same Transformers

Transformer Connections.

on such a circuit is objectionable as there is a gradual decrease of voltage from the beginning of the circuit at the substation to the extreme end of the circuit. Even with a voltage regulator on this circuit installed in the substation, this gradually decreasing voltage cannot be overcome; it is only possible to regulate the circuit for the average conditions on the circuit. The lamps which are near the station will receive extreme over-voltage while the lamps at the ends of the circuit will be below normal.

In the early history of this company it was customary to specify different voltage lamps for different portions of the city, the voltage specified being that which the circuit would deliver during the peak conditions in the various districts. We were using lamps rated in voltage from 98 to 115. This arrangement, while approximately accurate for the peak conditions, gave poor service at other times of the day when the load would be light when the lamps close to the substation would receive voltage below the ratings of the lamp, while those at the ends of the circuit would receive voltage above the normal ratings. At present the company is using one standard voltage for all lamps and have arranged the circuits to meet this condition.

A feeder system of distribution has been adopted and in most cases the system has been changed over by simply using the main circuit from the substation to the center of distribution and installing a feed-back

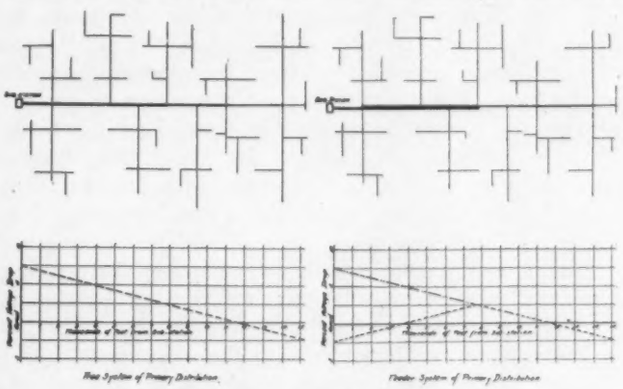


Diagram of Feeder System.

line from the center of distribution toward the substation, to which are connected the side lines in that district. The advantages gained by the "feeder system" are shown graphically by the accompanying diagrams. In these diagrams is given in plan a typical "tree and feeder system" of distribution and also what might be termed an "elevation" which gives the voltage drop for each system. It will be noted, how by the arranging of a feeder the total variations of voltage delivered to the lamps can be reduced from ten per cent total to two and one-half per cent above or below normal, simply by the use of a "feeder system."

A well designed feeder would not accomplish all the results desired without the use of a regulator for each particular circuit. The automatic induction type feeder regulator which has been developed in more recent years seems to fulfill all requirements and by means of the automatic attachments the regulator will compensate for the drop in voltage between the substation and the center of distribution as the load on the circuit damages. By referring to the accompanying chart it will be seen how nicely the regulator takes care of all voltage and load conditions and maintains practically constant voltage at all customers services. The chart has been compiled from four simultaneous Bristol recording voltmeter and amp. meter records, so as to show the voltage delivered at the substation by the main supply line; the regular voltage delivered to the feeder; the voltage delivered to consumers' premises some two miles distant from the station; and the load carried by the feeder.

Not many years ago it was considered that the "direct current system" of distribution, using a network supplied by feeders with a storage battery floating on the line at the substation, would give the best of regulation. By means of end cell connections the voltage at the substation was varied by the operator according to load conditions on the lines but with the most expert manipulation on the part of the substation operator, it is impossible to obtain a voltage chart which will in any way compare with charts which can be obtained from the a.c. service furnished by the automatic induction feeder regulator. In this connection, however, wish to call your attention to the very effective plan which is being carried out on the Los Angeles d.c. underground system, at this time. It will be remembered that we had been operating a two voltage bus the longer feeders being operated on a high bus and the close-in feeder on a low bus, so as to obtain an approximately constant voltage on d.c. network. On account of the increased load it was considered necessary to arrange for a third bus of a different voltage in order to get satisfactory regulation. However, in place of the multi-bus operation, a system has been put in effect using a single bus and pulling out or throwing in the various feeders as the load decreases or increases on the network so as to obtain approximately uniform voltage throughout the system.

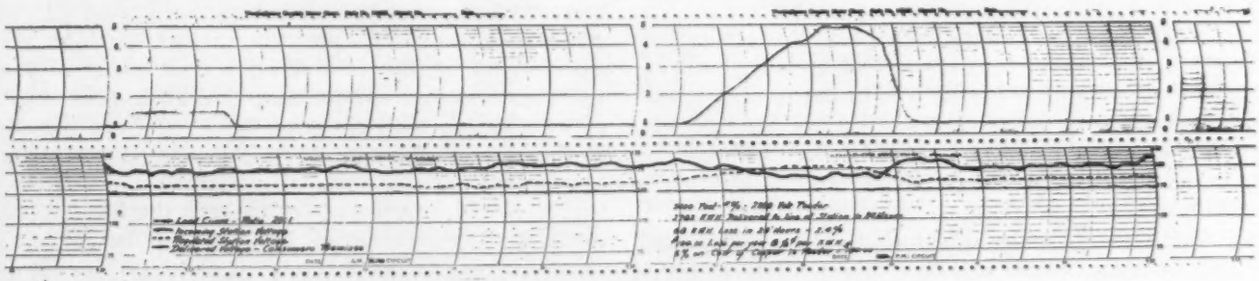


Chart of Voltage Regulation.

Pressure wires are brought from the various centers of distribution to the switchboard so that the operator in the substation is informed at all times of the condition existing at the various centers.

It is not attempted in this paper to state which of the various mentioned essentials are the most important, nor is it to be understood that the order in which the various matters are discussed is to show which is the most important. No doubt "safety first" should be our slogan in all matters and from that standpoint the essential of safe construction should have received our first attention. It can be stated that as continuous service has been made one of the essentials, it naturally follows that the construction must be safe, for with any construction which is unsafe, continuous service cannot be guaranteed. While the power companies have felt that they have been required to spend considerable money on account of the much discussed State Laws, Chapters 499 and 500, it cannot be denied but that these laws have brought about much safer construction than had existed heretofore and with the retroactive features of the laws properly taken care of the company's real objection to these laws would be eliminated.

Chapter 499 provides that primary wires must be on the opposite side of the poles from secondary wires in those cases where single arm construction is used, or where more than one cross arm is used primaries must be on the cross arm four feet above the arm carrying the secondary wires. This construction provides a safe arrangement for employes who must work on the lines. Chapter 500 has to do with the underground construction and practically all of its requirements were already standard practices of our company.

Joint pole construction has brought about much improved conditions where it has been necessary for several companies to operate along the same streets, alleys and property lines. Formerly, when companies occupied separate pole lines, there was grave hazard to the employes working on the lines as there was no regular order for the placing of the various companies' lines or was proper clearances allowed between lines of different voltages. One of the principal hazards to continuous service was the fact that the services taken off latterly from the line would in time tend to pull over the poles so that they would be burnt off by, or short circuit the lines of the other company. In addition to the increased safety in the construction of lines brought about by the joint pole work, we have the added advantage of a greatly reduced number of poles, which makes a much better appearance of the pole lines and decreased investment charge.

Since joint pole work has been inaugurated in Los Angeles, 54,200 combination poles have been installed, eliminating 76,500 additional poles which would have been installed with the old arrangement of all companies using separate pole lines. The photographs of Sixteenth street "before" and "after" show conclusively the advantage of joint construction.

Our experience has proven that cheap construction does not pay. There is a temptation often, in order to take on certain pieces of business which are beyond the usual distance for extensions, to put in a line for the time being which may satisfy the requirements, both as to capacity and mechanical strength, but which does not embody the features which will work out to the company's advantage in the future. One example of this is the practice which has been permitted in the past of using iron wire for conductors both on 2200 and 10,000 volt circuits, where only a small amount of load is to be transmitted and the conductivity of the iron wire is sufficient to deliver proper regulation. Many cases have arisen where, after this iron wire has been installed, the load on the lines has increased considerably and in a few months it was necessary to replace the iron wire with copper wire. The saving in interest on the original investment was more than exceeded by the cost of the labor for making the change.

A recent experience with iron wire has led to the issuing of instructions that it shall not be used hereafter on our lines. This case happened in Santa Ana District where there was a mile or more of iron wire on a 10,000 volt branch circuit. A tree fell across the line, short circuiting the wires. The automatic oil switch in the substation on this circuit was slow in releasing and the iron wire was completely annealed, and in a number of places the wire fell down of its own weight. On a system of small capacity iron wire might be permissible, but on a system the size and capacity of ours, iron wire should not be used.

Installations on consumers' premises should receive our closest attention and the safest possible form of installation provided. These installations are left in the care of the inexperienced consumer or his employes, and should be as near fool proof as it is possible to make them. We believe that the present type of secondary switchboards for power installations advocated by the company meets these requirements. The National Code has taken care of the proper method of installing the usual wiring in the houses for lighting. On small power installations it has been customary to install transformers on the pole so that only low voltage wires are brought into the customers' building; on larger installations, in the past, it has been customary to place the transformers inside the customers' plant. In case of 10,000 volt primary services it has been difficult to make an entirely safe construction of the high voltage wires within the building.

There still exists on our system numerous installations using bare 10,000 volt wires entering the buildings and the old type fused-horn-switch. A number of accidents have occurred, due to this form of construction. All plants which have been installed in more recent years have been equipped with cambric insulated cable which protects against the high voltage carried by the conductor, and in place of horn switches installed within the plant, an improved type of pole switch with enclosed fuses has been installed at the top of pole near the plant. We have had no accidents with this type of construction but believe that it would be even better to keep the high voltage wires entirely outside the buildings of the consumer.

To simplify the hanging of transformers on the pole, we have induced the manufacturing companies to

make for us a three-phase, outdoor type transformer in capacity from 10 to 100 kw. The method of installing these transformers is shown by the drawing No. 7646 and it can be further stated that this method not only eliminates the possible hazard of high voltage wires within the buildings, but the installation costs are reduced over the old practice as the customer is not asked to provide an additional space in the building for transformers and high voltage wiring; also the company obtains these transformers at a price somewhat less than the cost of equivalent capacity in two or three single-phase transformers, and there will be a further saving in the cost of labor and wire for the installation.

Much could be said in regard to proper location of pole lines so as to avoid unnecessary hazards from trees or nearby buildings. There are certain trees such as the eucalyptus, the limbs from which can easily be broken off by the wind and thrown across the lines, causing a shut-down and possibly serious damage. Being close to inflammable buildings introduces hazards which should be avoided as far as possible.

One very important requirement which should receives our attention is the grounding of all neutrals or transformers supplying 110 and 220 volts. It is only by this practice that we can protect the customers against the very possible condition of primary voltage being thrown on the secondary wires by breakdown of the insulation in the transformer, or the accidental contact of primary and secondary wires on the lines. The grounding of the secondaries has become the practice of all large companies and is recommended by the National Electrical Code.

Assuming that all the above mentioned essentials have been provided for, the buyer of the company's securities would not be satisfied unless he could be shown that the system was operating efficiently and that the results had been obtained at a minimum expenditure. One of the largest factors in the electric distribution system is the cost of conductors. It is important to see that proper sized conductors are selected which will deliver the service required and at the same time not be of a size larger than necessary for efficient operation.

Some years ago Lord Kelvin laid down the following rule:

"The most economical size of conductor is that one upon which the interest on the investment equals the cost of the loss of power." In applying this rule to a distributing system we must also bear in mind that a size of wire must be selected which will give proper regulation. It would be possible to have a condition where the requirements of Kelvins' law would be fulfilled and yet the voltage drop be so excessive that with our ten per cent regulators, we would not be able to deliver proper voltage. In this connection we will refer again to the voltage chart previously mentioned as an example to show the loss of power on the feeder as compared to interest on investment. In this case the cost of the loss of power on the feeder for a year at one-half cent per kw.-hr amounts to $124; six per cent on the cost of the copper in the line amounts to $150. These items are sufficiently close, allowing for reasonable increase of load, to comply with Kelvins' law.

Aside from the loss of power, due to line drop, the principal items to be taken care of are transformer core and copper losses. These losses can be kept down to a minimum by a judicious selection of the proper size of transformers for the load to be supplied; also by arranging to supply both light and power from the same transformers. In city distribution, it is quite usual to find conditions where motors are operating through the day, but disconnected at sundown. In such cases the same transformers which supply power during the day time can be used for supplying the lights in the same district during the evening hours. Our method of installing the high tension switch which controls the transformers for pumping plants or other power jobs, which operate intermittently, makes it convenient for the customer to disconnect the transformers when not in use and save the core loss.

From what has been stated in the foregoing, it can be readily seen that it would be impossible to accomplish all these results without careful planning of all extensions to the system. In a country such as ours, which is developing so rapidly, it has been a difficult matter to foresee in all cases just what would be the proper manner in which to make the extensions. There is this to be said, however, that invariably the load which has ultimately developed, has exceeded the normal capacity of the lines rather than the capacity of the lines exceeding the load.

To properly direct the new extensions which are to be made from time to time, a general development plan for each particular district should be laid out and as the actual extensions are made, they should be directed in so far as possible according to the plan which will work out for the best interests of the system as a whole. To accomplish this result requires a liberal policy on the part of the management and a close co-operation between the construction and new business departments so that in those cases where it is necessary to look to the future and install a line which may be somewhat heavier than the actual present demand would require, the extra expenditure may be authorized.

In the limited time allowed for the presentation of this paper it is impossible to go into many details. A volume could be written on the "down to date" methods of supplying street lights alone, aud it would be found that a careful study of the above essentials would reveal a right and a wrong way for installing a simple system of conductors and control apparatus for street lighting purposes. I have hoped to show that there is a wealth of interest, both technical and practical, to repay anyone who will investigate the details of the distribution work.

Setting concrete by steam has been successfully employed in constructing the 27 mile concrete pipe line from Sooke Harbor to Vancouver, B. C. The pipe is constructed in sections, each section being immersed in live steam for 24 hours, the steam causing the concrete to set as well as would otherwise be obtained by a month's exposure to the air.

ELECTRIC UTILITY FINANCING.

BY G. K. WEEKS.

(After discussing the difficulties of financing electric utilities, particularly as regards supplementary financing, the author suggests that non-assessable preferred stock affords the most logical means. This paper was presented before the San Francisco Section of the American Institute of Electrical Engineers, Feb. 26, 1915. Mr. Weeks is president of the Key System" and is associated with N. W Halsey & Co.—The Editor.)

The problem of financing electric utilities is certainly as important as any connected with the industry. The matter of the attitude of the state toward privately owned utilities is closely bound up, both as cause and effect, with the methods employed in public utility financing.

If an utility supplying a public necessity falls into the hands of an unscrupulous promoter, inflation in its security issues is apt to follow and then the loss or impairment of its credit. The company becomes unable to supply the facilities demanded by an exacting public. Public antagonism is aroused. The demagogue, whether in city council, legislature or in an executive position, finds no easier path to public favor than through an attack on the unpopular corporation. The capital which has been invested in good faith by the purchasers of bonds or stock is imperiled. There is no general sentiment in favor of protecting such corporation from wasteful competition, no matter what character of franchise it may hold. A franchise becomes a "scrap of paper." The electrical industry suffers; the public suffers. Perhaps municipal ownership, which I personally believe to be a turning from the best ideals of American individual initiative back toward the paternalistic bureaucracy which has made Europe what it is today, is finally dragged forward as a cure for an intolerable situation.

If, for example, the electric street car, which can supply the traveling public with efficient and dependable urban transportation at less than one-half the cost per seat mile of any jitney bus in existence, is allowed to suffer through unfair, unregulated and untaxed competition on the part of these itinerant vehicles to such an extent that investors suffer, all because astute politicians figure it is unwise to pass regulatory measures considered to be in the interest of the unpopular street car company, this means that the electrical industry suffers in favor of a less efficient rival. But it means more than this. It means that capital, proverbially timid, having suffered a loss in an excursion into the field of electric utility financing, will subsequently discriminate against this industry.

On the other hand, for public authorities to assume an unfair attitude toward honestly and efficiently financed and operated public utility corporations is a public calamity. An unsuccessful utility is bad for the community, even above the extent to which it is bad for its owners. As Mr. Sproule of the Southern Pacific Railroad tritely said in a recent address in the south, unless the capital invested in an utility enterprise is profitably employed, is prosperous, the clerks and the laborers engaged in the operation of the system cannot expect to be prosperous and the material men from whom rails and ties, poles and wires are purchased by the system cannot expect to be prosperous. I go further. A down-at-the-heel unsuccessful utility depreciates the value of every piece of real estate in the community it assumes to serve. It is a bad thing financially and socially for every citizen.

I referred a moment ago to municipal ownership as the only apparent solution in cases where the attitude of the public toward capital invested in privately owned utilities was so unfair as to scare away new capital needed for extensions and betterments essential to proper public service. May I pause to air one of my theories to the effect that the apparently strong tendency on the Pacific Coast toward municipal ownership of electric as well as water utilities is not due to any greater prevalence of socialistic dogma here than in the East, the general Eastern opinion to the contrary notwithstanding. I consider this tendency, on the contrary, to be due to an ungovernable determination on the part of the ambitious Western population that the facilities which are believed to be befitting their progressive cities shall be immediately achieved—if private capital does not respond with alacrity, then by the municipality itself. Stopping not at all to consider that the latter estate may be worse than the first.

Passing to the more technical aspects of this question of electric utility financing it may be observed that the conditions controlling the financing of public service corporations are materially different from those affecting industrial corporations. It would appear on both legal and economic grounds that it is impossible for the owners of public utility property to retire from business at will or even to abstain from investing new capital in betterments and extensions. From an economic standpoint it is usually so desirable to take on new business adjacent to existing lines or mains as to amount to a practical business necessity—both because the income should be much greater than the increase in operating expense and because otherwise competition would be encouraged. Entirely apart from this, however, the California law appears to give the State Railroad Commission authority to compel the giving of service within the territory which an utility has "held itself out" to serve, even though this involves the raising of new money for extensions. Municipal enactment calling for the placing of wires underground, street paving safety devices, etc., also compel considerable capital expenditure.

The primary financing of public utility corporations is usually done by the sale of mortgage bonds. The raising of additional money required for capital purposes through other—presumably junior—securities is quite generally termed by the utilities and by bond houses "Supplementary Financing."

It is clear on principle, as also appears as the result of practical experience, that these corporations cannot expect to obtain through the sale of bonds all the money required for capital expenditures. The lender, putting out his money at a comparatively low rate of interest in the purchase of a corporation bond, is entitled to a liberal margin of security. The lender on real estate has a precise security, presumably easily salable and is usually able to exercise the right of foreclosure, if it becomes necessary, without meeting

any particular complications. Under these circumstances he will not ordinarily loan more than two-thirds the appraised value of the real estate mortgaged. Public utility bonds frequently run from thirty to fifty years covering property subject to many economic and political vicissitudes and changes in management. Furthermore, the remedy in case of default is more difficult of enforcement than in the case of the real estate mortgage, the small bondholder being, in such event, to a considerable extent dependent upon the vigilance of the trustee or some organization among fellow bondholders induced by the necessity of mutual protection. It is evident therefore, that the bond buyer should properly require an equity in the property mortgaged over the amount of his bond issue as great as that required by the lender on real estate.

It seems proper that this equity should be created by investment on the part of stockholders, the owners of the property who through their voting power are in a position to control the management of the property and who are entitled to the profits remaining after the payment of operating expenses and interest on money borrowed. Influential members of the California Railroad Commission have expressed the opinion that not more than 75 per cent of the investment in a utility property should be raised through the sale of bonds, the balance being obtained by the sale of stock. The most potent factors, however, in forcing some "supplementary financing" are the restrictions on the issuance of bonds which conservative bond houses insist on incorporating in mortgages as a condition precedent to handling the bonds issued thereunder. In addition to other restrictions, it is usually provided that bonds subsequent to the original issue, which is purchased after an investigation of the property owned, may be issued only for a specified percentage of actual expenditures for the construction or acquisition of additional property. The percentages most frequently stipulated range from 66 2-3 to 90 per cent.

Thus, from one-tenth to one-third of capital requirements must be obtained through "supplementary financing" or from surplus earnings, which is merely one form of contribution by stockholders. It is obvious that the more rapidly a corporation grows, necessitating new construction and extensions, the more "supplementary financing" is necessary and consequently the less likely it is that surplus earnings will suffice to provide the capital, required over and above that obtainable from the sale of mortgage bonds. For this reason some of the most progressive and potentially properous corporations have found the problem of "supplementary financing" most perplexing.

Prior to the assumption by the California Railroad Commission of jurisdiction over public utility rates and security issues the problem of "supplementary financing" was not generally considered acute in California. Many original bond issues had been put out in sufficient amount to provide all the money initially required and well managed companies were able to show earnings sufficiently large to substantially supplement the proceeds of bonds sold. In some cases common stock was given as a bonus to make possible the sale of bonds at their full par value or was sold in the market or to stockholders at prices sufficiently attractive to assure its sale even though this might not be more than 30 to 60 per cent of its par value.

The Railroad Commission however, at an early date laid down two rules vitally affecting the problem of "supplementary financing," which, according to my understanding, may be stated with substantial correctness as follows:

Rule "A." That the par value of all securities authorized to be sold, stock as well as bonds, must be approximately covered by the actual value of property devoted to the public service; or, more practically stated, that the commission would not, as a rule, authorize the sale of either bonds or stock at less than 80 per cent of their par value; and

Rule "B." That additional stock or bonds of issues outstanding before the commission acquired jurisdiction would not be authorized unless the entire outstanding issue measured up to the standards established by the commission, e.g.: if the value of a corporation's property as found by the commission amounted to only 50 per cent of the par value of an outstanding preferred stock issue, after providing for senior obligations, the sale of an additional installment of this preferred stock would not be authorized by the commission, even if such additional installment could be sold for a price which per se would be satisfactory.

The effect of Rule "A" was to make unavailable for use in "supplementary financing" any stock issue which could not be marketed at a price of 80 or better while Rule "B" eliminated many issues of preferred stock which were marketable above 80 and which otherwise would be available for financing.

It becomes evident therefore, that no electric utility in California, or any other state where the issuance of securities is subject to the approval of a railroad or public utility commission, can be considered as occupying a safe position unless it can issue securities salable with the approval of such commission for its primary financing. It seems equally necessary, if mortgage bonds are sold for this primary financing, that stockholders should, in some manner, provide for "supplementary financing." Surplus earnings available for reinvestment in property are not ordinarily large enough to take care of this "supplementary financing." Stock assessments are unpopular and unsatisfactory for reasons so obvious that no argument is necessary to demonstrate that they can only be considered as emergency expedients. It is also unsound policy, except as an emergency measure, to attempt to do "supplementary financing" through the medium of short term fixed charge obligations—notes or debentures—because the necessity for additional "supplementary financing" continues year after year and the putting out at a discount of short term obligations, which themselves have to be paid or refunded in a comparatively short time, in addition to the raising of new money for future requirements, merely postpones and aggravates the problem of "supplementary financing."

There should, therefore, be some authorized stock issue which is salable for "supplementary financing." The issuance of common stock for this purpose is conservative and desirable if it can be sold at 80, the minimum price allowed by the California Railroad

Commission. This is necessarily predicated either on very large surplus earnings or a well established record of substantial dividends. While it should be possible with good management and fair rates to make common stock salable for "supplementary financing" in the case of companies where substantially all the outstanding stock represents property investment, it is quite impossible in the case of companies which already have outstanding in the hands of the public a par value of stock materially in excess of the value of the property owned as recognized by the Railroad Commission.

Where common stock cannot be sold a non-assessable preferred stock affords a logical medium of "supplementary financing," and I believe this class of stock will become the standard for the purpose. The inequity of having a preferred stock which is limited as to dividends and liquidation value subject to assessment equally with common stock is so obvious that investors will naturally demand and common stockholders should readily concede the granting of the feature of non-assessability, provided it can be legally done, as now seems well established.

If the issuance of such non-assessable preferred stock is complicated by the position of a pre-existing preferred stock issue which is not available for use, the officers or bankers of a corporation should, I believe, in any given case meet the situation through some adjustment, fair to existing security holders and meeting the requirements of the railroad commission, such as that which has been so successfully planned and carried into operation by the Pacific Gas & Electric Company, which is so extensively represented in your membership.

Pacific Service Day at the Panama-Pacific International Exposition was celebrated March 15th, by the attendance of nearly 6000 officials and employees of the Pacific Gas & Electric Company, from all its offices and plants throughout Northern California, as well as representatives of many electrical concerns in the state. John A. Britton, vice-president and general manager of the corporation, and a director of the Exposition, was chairman of the day. Addresses were given by Mayor Rolph, C. C. Moore, president of the Exposition; H. D. Connick, director of works; Guy L. Bayley, chief electrical and mechanical engineer; D. D'A. Ryan, chief of illumination, and others. President Moore presented a bronze plaque, expressive of the Exposition's appreciation of "Pacific Service," to President F. G. Drum, of the corporation. President Drum replied in a brief speech of thanks. In the presentation President Moore voiced the sentiment of the gathering: "We are all wearing badges this morning. It is a corporation badge, and it is a badge of honor. You are proud of this corporation. I am proud of it. The whole state is proud of it. I ask you all to think of the unusual purpose of this day—to honor a California corporation." Moore proceeded then, in detail, to explain the great assistance the company had been to the builders of the Exposition, saying that he could never properly express his appreciation of its co-operation in making possible the wonderful lighting effects.

WHAT THE ELECTRICAL CONTRACTOR SHOULD KNOW.

BY F. D. WEBER.

(A succinct statement of the difficulties under which the contractor is laboring and suggestions for eliminating them are made in this paper, which is part of a general paper on "The Underwriters and the General Contractor" presented before the O. A. C. Branch A. I. E. E., Feb. 16, 1915. The author is electrical inspector Underwriters' Equitable Rating Bureau at Portland.—The Editor.)

The electrical contractor in the past has not been considered in a professional way or in a business way as deserving of much consideration. It has been said that there was only one class of men harder to do business with than the electrical contractor and that was the plumber. He always seemed to glorify in a slovenly personal appearance and his place of business—if he had one—had the appearance of a junk dealers' establishment. Do not understand that there were not exceptions to this rule—as there were—but they only tended to emphasize the general condition.

The electrical contractor has had very little encouragement, many things have hindered his development and business; some of these things are expressed as follows:

1. Attractiveness of the business to amateurs.
2. Carelessness and ignorance among workmen.
3. Indefinite specifications furnished by architects.
4. General disposition of public to desire cheapness.
5. Competition among the contractors themselves—"cut-throat methods."
6. "Carpet bag" competition.
7. No state restriction as to license restrictions for contractors.
8. Lack of experience within the ranks of the contractors.
9. Faulty or incorrect inspections by inspectors.
10. Lack of co-operation among contractors.
11. The rapid changes taking place in the science of electricity.
12. Lack of co-operation between architects and contractors.
13. Lack of co-operation between the jobbing trade and the electrical contractors—as regards price protection.
14. Ignorance on the part of a high percentage of the electrical contractors as regards plain business methods and how to figure their legitimate profits.
15. Lack of pride in their work and business.
16. Lack of proper co-operation between central station and contractor.

The electrical contractor of the past was recruited from the ranks of the electrical workman, and many times his opportunities for acquiring business experience and education together with technical training were very limited. It was only the Abraham Lincolns of the business who have succeeded and they should be accorded all manner of praise. They were true pioneers.

Many schemes have been devised by city councils and commissions to regulate and make more efficient the electrical contractor, with more or less success, but no solution has been ideal. Some of these methods are as follows:

1. Annual License Fees.
2. Examinations.
3. Surety Bonds.

4. Cash deposits.
5. Personal bond and guarantee by citizens of reputation.
6. Simple registration and taking our permits.
7. License fee 7 supervising electricians on each job.

The last named is used in Chicago with a few exceptions and will be a part of the new Portland Electrical Code. It reads as follows:

"Any person desiring a permit to perform electrical work under this Code in or on any building in the city (except an owner as provided in paragraph 3 of this section) shall file, with the Bureau of Buildings, an affidavit setting forth that all work to be done under any permit issued to him during the period of his registration will be performed under the direct supervision or control of a person registered as a supervising electrician in accordance with the provisions of Section 9 hereof. Upon the filing of the sum of twenty-five ($25.00) dollars as an annual registration fee, the Bureau of Buildings shall issue to the applicant a certificate of registration which shall entitle him to sign applications for electrical permits as hereinafter specified. The name and authorized signature of the applicant, his place of business, residence and telephone number, if any, shall be filed with the Bureau of Buildings."

"If any registered applicant refuses or neglects to comply with the provisions of this ordinance within reasonable time after having received written notice of any violation discovered by the Bureau of Buildings, the certificate of registration may be cancelled by the Bureau of Buildings. In addition thereto the penalty provided in Section 18 of this ordinance may be enforced, and all work installed under any permit in violation of this ordinance shall be corrected and made to comply therewith. A new certificate of registration shall not be issued until all violations theretofore committed shall have been corrected."

"A permit may be issued to an owner to perform electrical work in or on his own building if all of the work is performed by himself in person. If a permit is issued to an owner, so to do, the permit shall be void if any other person or persons perform any of the work called for under the permit."

"If the person who has applied for a permit desires to change the supervising electrician during the progress of the work, he may do so but must notify the Bureau of Buildings in writing of such change."

"Every person desiring to register as a supervising electrician, shall file with the Bureau of Buildings an application for registration and an affidavit setting forth that the applicant is not less than twenty-one (21) years of age and has had not less than four (4) years practical experience in the installation, alteration and repair of electrical wires and apparatus. In addition the affidavit shall contain the statements of two responsible persons of legal age to the effect that they know the applicant has had the four (4) years' experience as required, and that they believe him to be qualified to perform such electrical work as is controlled by the Code. Upon the approval of the affidavit by the Bureau of Buildings, the applicant shall receive therefrom a certificate of registration empowering him to countersign applications for electrical permits, and to perform, direct electrical work authorized by such permits for the current calendar year. The certificate of registration shall be renewed annually on the first day of January thereafter. The certificate of registration may be revoked at any time by the Bureau of Buildings if at any time the affidavit filed is shown to be false, or if the person registering as a supervising electrician refuse or neglect to comply with any of the provisions of this ordinance. In addition he shall also be liable to the penalties provided in Section 18 of this ordinance. If such certificate of registration shall have been revoked for any reason no renewal of the certificate shall be allowed for a period of six (6) months thereafter.'

"The supervising electrician may be released from further responsibility if the Bureau of Buildings is notified in period of six (6) months thereafter."

This appears to put a premium on experience instead of ability, but at any rate is an improvement over most schemes devised to increase efficiency and protect the property owner. Nevertheless the raising of efficiency must come through education and legislation will do very little towards raising it. Still it emphasizes the lack of efficiency.

At the present time a great reaction has taken place in the old school of contracting and they are now being educated by a National Association, which is disseminating knowledge concerning correct methods of figuring costs. The contractor is learning also that co-operation with his fellows is more to his advantage than cut-throat competition.

It is high time that the electrical contractor realizes his position in regard to the electrical industry as acknowledged by others. When we realize that the manufacturer, the supply house, and the consulting engineer seldom are brought in direct contact with the customer, but that the contractor is, he must be properly equipped to give that customer service as well as the proper impression of the electrical business in its largest sense.

He should know all forms of the lighting company's contracts and the service available in all parts of the city in which he does business. He should be familiar with every device and apparatus on the market (which runs into hundreds of thousands) and know where to get the material best suited for the work at the right price. He must also be familiar with all the Underwriters' or the city department's requirements and the interpretation of same by individual inspectors. He should have a good knowledge of building construction. He should be artistic and understand inside and outside methods of decoration. He should be able to look ahead and advise customers regarding future extensions and expansions. He should know the fundamental principles of salesmanship. He should know how to size up workmen and how to organize them to get the best results out of their labor. He should have a complete set of measuring instruments in order to be able to make accurate tests on engines, generators, motors, etc., locate trouble and give advice. He should have a thorough understanding of all methods of winding of electrical machinery as well as their construction in order to repair same. He should know the fundamental principles of electrical engineering, together with the mathematics pre-requisite for same. He should be thoroughly grounded in business methods and commercial law. He must be, above all, able to figure costs of material and labor correctly and make the proper allowance for profit on every job.

Most lines of electrical engineering are specialized but the electrical contractor has to include every field in his business and if he is not a specialist in all these lines his training should equip him to specialize in any particular line in the most rapid and efficient manner.

INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

OIL IN THE IRON AND STEEL INDUSTRIES.

In the open hearth process of making steel the impurities in the pig iron are removed by the action of the flame upon an open bath of the molten metal. A very high temperature must be maintained in such a furnace to keep the iron thoroughly melted, and for this reason the air for combustion is heated to over 1000 deg. F. before it enters the combustion chamber. Measured quantities of ore, iron scale, or other oxides are added to the bath of molten metal, and these, reacting with the impurities present, serve to keep it thoroughly agitated. If the pig iron or scrap contains too much phosphorus, burnt lime is added to the charge, and the resulting slag absorbs the phosphorus.

There are many advantages in the use of oil as a fuel for open hearth furnaces. The cost of keeping such a furnace in repair is approximately 40 per cent less than when gas is used. The heat of the furnace is easily regulated, and a more even temperature may thus be maintained. Different chemical reactions take place in the furnace, producing a superior quality of castings; and a lower grade of scrap iron can be used with fuel oil than with producer gas. As a result of these advantages many large steel plants in the East have equipped their furnaces for the use of fuel oil. In localities where natural gas is abundant and coal is cheap, the oil installation is merely an auxiliary; it does not in any way interfere with the regular operation of the furnace with the other fuel, and is ready for use at a moment's notice.

Open hearth furnaces may be very simply and inexpensively equipped to burn oil. Fig. 66 shows the general arrangement of piping, burners, pumping systems, reversing stand and storage tank for a plant having two furnaces. The necessary apparatus for one open hearth furnace consists of two burners (one for each end of the furnace), a reversing stand located

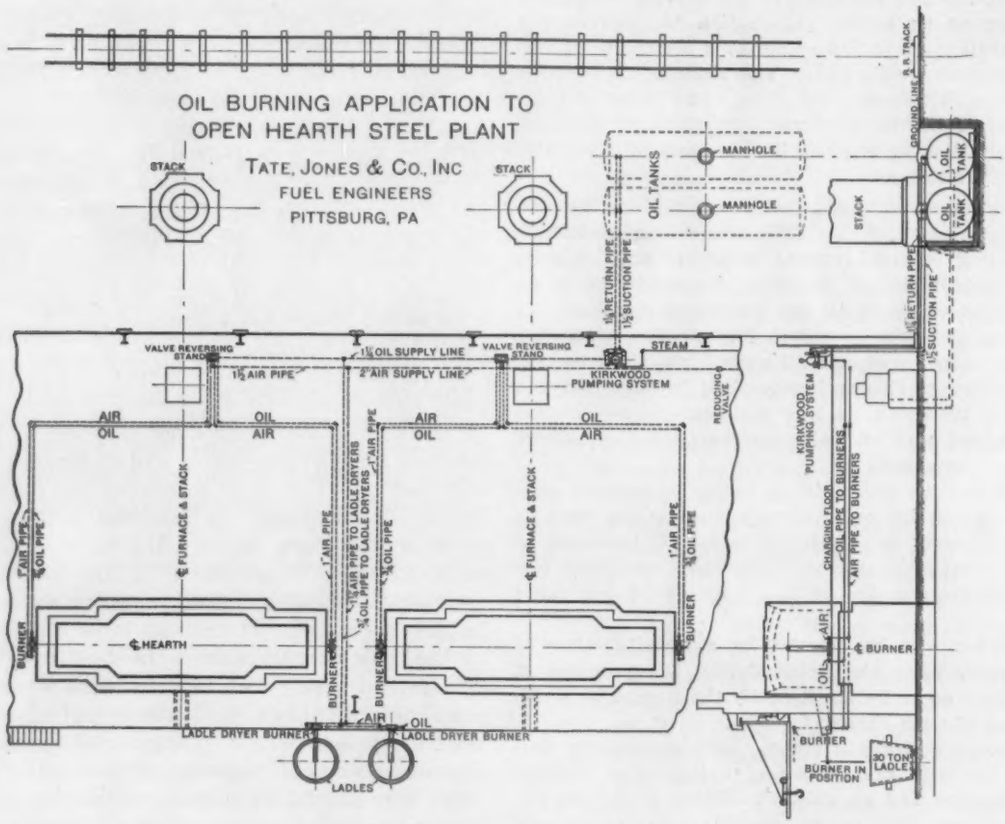


Fig. 66. Piping Diagram of Oil Fuel Installation in Open Hearth Plant.

back on the charging floor for reversing the flow of the oil and the atomizing agent as the furnace is reversed, a pumping system for pumping oil from storage tank and heating and regulating the supply to the burners, a reducing valve for regulating the atomizing agent (air or steam) and the necessary valves, pipe, tank and fittings as shown. The reversing stand shown in Fig. 67 is used in the regenerating type of furnaces, in which the draft is changed at certain intervals from one side to the other, thus allowing the air to pass through the regenerative chamber, which is built of checkered brickwork. The waste gases flowing from one side of the furnace pass into this chamber and the brickwork absorbs a large part of the heat which they contain; by reversing the flow of the gases from one side to the other, the air for combustion comes in contact with these hot bricks and is preheated.

A swinging burner is commonly used for firing open hearth furnaces. When the furnaces are close together, or the end of the furnace is so near to the wall of the building that there is not room for the

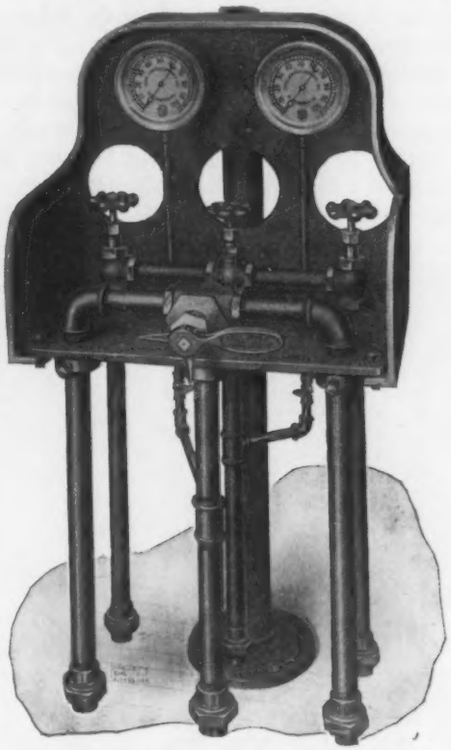


Fig. 67. Reversing Valve Stand.

use of a swinging burner, a water-cooled burner is used, as illustrated in Fig. 68. Such a burner remains permanently in the furnace, both the burner and the

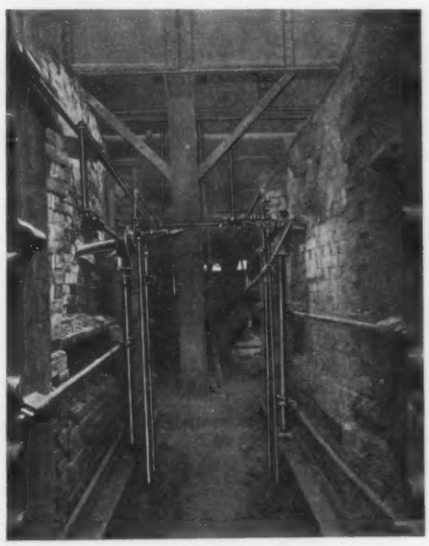


Fig. 68. Water-Cooled Burners Applied to Open Hearth Furnace.

water-cooled nozzle being swung in a yoke, so that the nozzle may be elevated or lowered as required. A circulation of water through a ¾ in. pipe prevents the burner from being melted off by the heat of the furnace.

[To be continued.]

HINTS ON IRRIGATION.

BY FRANK ADAMS.

The application of more water than the soil will retain or than the crop irrigated requires is injurious to the soil and wasteful for both the individual and the state.

The purpose of irrigation is to get adequate moisture into the rooting zone of the crop irrigated and not merely to apply water to the soil surface. (Buy and use a six-foot auger and know what becomes of the water applied.)

Long irrigation furrows and long checks make even application of water impossible.

In orchard irrigation it is as important to irrigate directly in the tree rows as to irrigate between them.

Basin and flooding irrigation of orchards result in unnecessary puddling and excessive evaporation and may double the cost of cultivation after irrigation.

Orchards should be irrigated by means of furrows if you can get the water where you want it with furrows. (Use your soil auger to find out.)

The principal wastes in irrigation come through leaky farm ditches, run-off at the lower ends of furrows and checks, excessive application, resulting in too deep percolation, and surface evaporation due to too little or too shallow cultivation. (Look out for them!)

Plants require most water when they are making the most rapid growth.

Crops should be irrigated before they begin to suffer for lack of moisture.

The ideal in irrigation is, in general, to maintain uniform moisture content of the soil throughout the growing season.

Beyond a certain point the application of additional water does not increase yields and may decrease them.

BYLLESBY OFFICER ON CALIFORNIA CONDITIONS.

Early enlargement of the capacity of the Western States Gas & Electric Company's hydroelectric plant on the American River in California was announced by Otto E. Osthoff, vice-president and chief engineer of H. M. Byllesby & Company in a recent interview in the Stockton Record. Mr. Osthoff is at present inspecting the utility properties on the Pacific Coast managed by his firm. He is reported as having said:

"The decision of the State Railroad Commission in the Oro case, which was sustained by the State Supreme Court last week, has strengthened the faith of Eastern investors in California. It has demonstrated to them that investments in California are going to be protected. I am sure that all California enterprises dependent upon Eastern capital are going to be helped by the effect of the decision.

"California is probably second among the great regions of America in point of prosperity today. I should say that the upper Mississippi Valley ranks first. Your present prosperity is perhaps largely due to the fact that you have two great expositions on in your state. The people are coming here and they are spending their money. Then, too, you are raising so much foodstuff, which lends stability."

P. P. I. E. MACHINERY EXHIBITS

Westinghouse Transportation Exhibit.

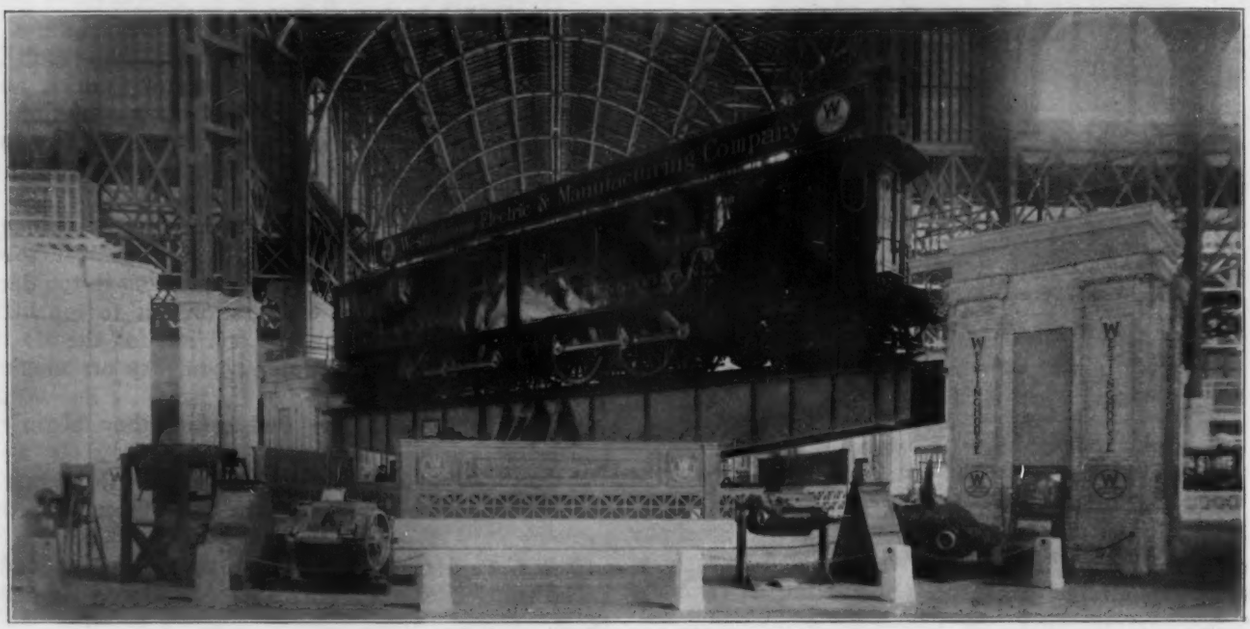
A recent picture of the exhibit of the Westinghouse Electric & Manufacturing Company in the Transportation Palace is shown herewith. The Pennsylvania locomotive mounted on a revolving turntable in the center of the building, is one of the most striking exhibits in the exposition. The turntable is 65 ft. long, and weighs 440,000 pounds, including the locomotive. The height of the track is 12 ft. above the floor, and steel ties are used, a new type of construction for this class of work.

By means of a 10 h.p., 3 phase, 220 volt motor the turntable is caused to revolve at a speed of once in three minutes, thus giving the crowds at each end of the building different views of the locomotive. The rotation, which can be reversed in direction, is under the control of the operator located in a booth near by.

A decidedly unique method of collecting the current for lighting the locomotive is employed. This was designed by the Westinghouse engineers and involves bringing the leads up through the center bearing, to collector rings, thus obviating the use of third-rail shoes or trolleys. The locomotive is arranged and lighted so as to permit the people to pass through it and inspect the equipment.

This locomotive is said to be the largest in the world in passenger service. It consists of two units and weighs 156 tons, and is the first side-rod gearless locomotive ever placed in service. It is equipped with two motors having a total capacity of 4000 horsepower and Westinghouse unit switch control equipment of the HBF type, which has made the phenomenal record of 99,549 miles per train minute delay power control failure. Twelve million passengers annually are transported over the electrified terminal of the Pennsylvania Railroad from Harrison, N. J., to the Pennsylvania Station, New York City, by these locomotives, which are capable of attaining a speed of 60 miles an hour with full train.

In addition to the locomotives, the newly developed types PK and HL Control for railway motors are shown in actual operation. These control equipments operate motor trucks equipped with 40 horsepower motors. The PK Control operating head can be applied to any standard type E Controller.



Westinghouse Transportation Exhibit.

A complete line of commutating-pole railway motors, including box and split-frame types for various voltages, from 600 to 1500, are also shown, and in addition a preliminary sample of the new pressed steel railway motor.

The U. S. Geological Survey's exhibit in the Palace of Mines and Metallurgy represents the evolution of undeveloped districts in the arid west. The results of steam gaging have been utilized in planning a power plant and an irrigation project. A coal bed is being mined on one side; an oil field is under development elsewhere; a sandstone bed is being quarried in the foreground; mining and milling are in progress in the mountains; a town has been built and roads, railroads and other evidences of civilization abound. A series of cases illustrate what our common things are made of, what the raw material looks like as it is obtained from the earth, and where it occurs in the United States. For example, many of the familiar household articles are there, such as an aluminum saucepan, an electric-bulb filament, and a fountain-pen point; and above each article is shown the mineral from which it is made, traced back to the ore, and then a map of the United States, showing where the ores occur. At the west end of the space is an exhibit of the power and fuel resources of the United States.

ELECTRICAL DEVELOPMENT IN CALIFORNIA.

BY B. B. BECKET.

In support of the claim that the Pacific Coast has taken the lead in "doing it electrically," the following tables may be labelled "Exhibit A." The basis for these figures is Bulletin No. 124 of the United States Census Bureau, "Electric Control Stations and Street and Electric Railways," for 1912. The totals obtained from this bulletin have been divided by the population in each case, obtained by taking the United States census population of 1910 and adding two years' increase at the average rate for the preceding decade.

It will be noted that California leads all down the line, except in the price charged, and from the point of view of the consumer or prospective settler, California leads in this respect also. The revenue per kw.-hr. generated is less than two-thirds the average for the United States and one-quarter that in the state of Iowa, while the revenue per capita is more than three times the average and nearly six times that of Iowa. The output in kw.-hr. per capita is nearly six times the average and twenty-three times that in Iowa. The h.p. of motors served per capita is 5½ times the average and over twelve times that of Iowa. The state of New York is a little above the average.

Similarly in electric railways, the revenue per capita in California is more than twice the average and more than four times that of Iowa, and so on. The railway statistics, as might be expected, are not so favorable, and yet surprisedly so, considering that California has no natural claim upon electric railways such as she has in water power.

It might be concluded from the foregoing that California had reached the saturation point, perhaps even "over-produced," but the contrary is indicated by the rate of increase shown in the last two items in each table. Perhaps the most striking figure of all is given in the last item of Table 1; the station output per capita in California increased 120 per cent in five years. Note that this instance is stated "per capita," that is, allowance being made for increase in population.

Lest anyone from the state of Iowa should think his state had been singled out to be picked upon, it should be stated that Iowa was chosen at random as a representative Middle Western, rural state. Also, lest there should be hurt feelings in the North Pacific States, the explanation should be made that an accurate segregation of central station statistics from those of electric railways is not possible in those states on account of the large amount of joint operation.

STREET AND ELECTRIC RAILWAY STATISTICS FROM U. S. CENSUS OF 1912.

Division.	United States.	California.	Iowa.	New York.
Population, 1910 census	91,972,266	2,377,549	2,224,771	9,113,279
Population, 1912, estimated	95,000,000	2,515,000	2,230,000	9,550,000
Population, per sq. mile, 1912	31.6	16.1	40.2	200.5
Population, rural, in per cent of total	53.7	38	69.	21
Funded debt, per capita	$24.48	$65.60	$11.08	$50.40
Operating revenue, per capita	5.98	13.54	3.34	12.43
Operating ratio, per cent	59.7	63.6	61.3	56.0
Passengers carried, per capita	127.8	271.8	49.1	259.0
Revenue, car-miles, per capita	20.2	46.3	9.9	43.0
Passenger car-miles, in per cent of total	98.1	94.7	94.5	99.4
Passenger revenue, in per cent of total	88.6	91.1	71.3	93.3
Miles track operated per million population	432	1,035	352	470
Cars operated per million population	990	1,850	657	1,892
Passenger cars in per cent of total cars	81.0	60.0	65.6	89.1
Cars with motors in per cent of total	78.5	60.5	56.5	78.5
Electric locomotives per million population	2.9	19.5	9.9	3.1
Funded debt per mile of track	$56,600	$63,400	$31,500	$107,250
Operating revenue per mile of track	13,820	13,100	9,500	26,480
Cars operated per mile of track	2.29	1.79	1.87	4.03
Passengers carried per mile of track	296,000	262,000	139,500	551,000
Revenue, car-miles, per mile of track	46,800	44,700	27,600	91,500
Average revenue per passenger	4.67c	4.98c	6.81c	4.80c
Average revenue, per car-mile	29.6c	29.2c	33.8c	28.9c
Average wages per wage-earner	$674	$752	$661	$688
Cost of fuel per kw. hr. generated (approximate)	0.4c	0.685c	0.462c	0.4c
Average cost per kw. hr. purchased	0.827c	0.693c	1.307c	0.885c
Increase of revenue per capita, 1907-12	24%	41%	71%	17.4%
Increase of car-miles per capita, 1907-12	8.6%	30%	29%	8.6%

Note.—The figures include all street railways and electric railways, including electrified portions of steam railroads, wherever segregation is possible. Wherever a railway company conducts other operations, such as the sale of electricity, water, etc., such operations are segregated wherever possible and are not included. This was not possible in regard to funded debt, however.

ELECTRIIC LIGHT & POWER STATISTICS.

Compiled From Bulletin No. 124 of the U. S. Census of 1912.

Division.	United States.	California.	Iowa.	New York.
Population, 1910 census	91,972,266	2,377,549	2,224,771	9,113,279
Population, 1912, estimated	95,000,000	2,515,000	2,230,000	9,550,000
Population, per sq. mile, 1912	31.6	16.1	40.2	200.5
Population, rural, in per cent of total	53.7	38	69.	21
Funded debt, per capita	$9.79	$63.10	$4.62	$15.88
Operating revenue, per capita	3.02	10.52	1.83	5.57
Operating ratio, per cent	63.9	58.3	70.0	72.9
Output of stations, kw. hr., per capita	122	695	30.2	228
Primary power, h.p. per 1000 population	79.3	337.5	34.6	121.0
Number customers, per 1000 population	40.4	152.7	40.5	45.5
Motors served, h.p., per 1000 population	43.6	240.0	19.8	83.3
Incandescent lamps, per 1000 population	805	2,702	678	1,350
Arc lamps, per 1000 population	5.4	9.9	2.1	9.9
Funded debt per customer	$242.00	$413.00	$114.00	$349.50
Operating revenue per customer	74.70	68.80	45.20	122.50
Primary power, h.p., per customer	1.96	2.34	0.86	2.66
Output of stations, kw. hr., per customer	3,015	4,550	743	5,020
Connected load, kw., per customer (approximate)	2.11	2.39	1.38	3.35
Revenue, per kw. hr., generated	2.48c	1.515c	6.07c	2.44c
Revenue, per kw. hr., connected (approximate)	$35.40	$28.80	$32.75	$36.55
Revenue, per h.p., primary power	38.10	29.45	52.90	46.00
Kw. hr. generated per h.p. primary power	1,535	1,945	870	1,887
Kw. hr. generated per kw. connected (approximate)	1,430	1,904	539	1,498
Water power in per cent of total primary power	33.6	51.3	10.4	44.3
Increase, 1907-12, in revenue, per capita	55%	58%	75%	30%
Increase, 1907-12, station output, per capita	81%	120%	78%	33%

Note.—The figures include both commercial and municipal stations, but not private plants. Wherever other operations, such as railways or gas, were conducted jointly with the sale of electricity, these were segregated wherever possible and not included, but no segregation was possible in case of funded debt.

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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The Certificate of Convenience and Necessity

It is a matter of congratulation to the public utilities of Washington that a law has been passed in that state providing for a certificate of convenience and necessity. This bill passed both houses of the Washington Legislature and as it was prepared by Chairman Reynolds of the Public Service Commission with the Governor's approval, there is every likelihood that it will be signed.

The bill provides that no new public utility shall be constructed to render a service similar in character and location to that rendered by an existing utility without first obtaining a certificate of public necessity and convenience from the commission. The term "public utility" includes street and interurban railways, electric, gas, water and steam heating plants, whether municipally or privately owned. Telephones were excluded because of the pressure brought to bear by the independent telephone companies operating in rural districts. Special credit is due to the Pacific Telephone & Telegraph Company for its broad gauged policy in not fighting this measure.

The bill for an indeterminate franchise did not come up for final hearing in the Senate before adjournment, although it passed the House. An effort will undoubtedly be made to have such a measure passed at the next session..

This law is in accord with the best thought regarding the regulation of public service corporations. Regulation should include protection against inequitable competition, whether private or public. It is to be sincerely hoped that other Western states will follow the precedent set by Washington and incorporate similar provisions in the laws regarding the control of public utilities.

"A foolish man, which built his house upon the sand; and the rain descended, and the floods came, and the winds blew, and beat upon that house; and it fell, and great was the fall of it."

A House Built Upon the Sand

As a modern and pertinent application of this parable consider the public utility structure which has been erected upon the unstable foundation of public dissatisfaction and distrust. It seemed so much easier to disregard public opinion, not to bother about establishing cordial relations, and to save the cost of the cement of brotherly love and affection, that the builders of many a public service corporation concentrated their efforts upon the superstructure and neglected the foundation. And now that the storm of regulation and competition has arisen, they realize that the edifice is in danger of collapsing like a house of cards.

The clouds are gathering and in some places the storm has burst. Though much of the western sentiment for municipal ownership is due to the people's characteristic impatience with private capital's lack

of alacrity in responding to demands for service extensions, as has been admirably set forth elsewhere in this issue by Mr. G. K. Weeks, the designing demagogue is not averse to fanning this smoldering ember into flame. The misfortunes of the Western Pacific railroad and the power possibilities of the Los Angeles aqueduct have been avidly seized as excuses for extending political ownership. The jitney bus thrives on popular prejudice as does likewise the "hold up" duplicate utility.

However, the ancient parable does not consider the possibility of reinforcing the foundations. In many cases it is not too late to build supplementary foundations of public confidence. The public service corporations have frequently lost by default; public distrust is rooted in ignorance; full and frank publicity will educate the public to the fact that an unsuccessful utility works more harm to the community in which it operates than to its stockholders.

To eliminate general hostility it is usually sufficient to allow the action and attitude of the company to speak for themselves. Courteous treatment, honest methods and a clear explanation of financial results will always disarm suspicion. Absolute truthfulness is always essential.

The public service company whose house is builded on the rock of public confidence can not only weather these storms but can protect its most vulnerable point —its stock and bond issues. Everyone except the public service commissions recognize that good will is an asset of definite intrinsic value in making for stability of earnings. Ill-will, likewise, is a liability. So even where there is no likelihood of competition, if is a matter of profit to build better public relations.

The Super-Contractor

After reading Mr. F. D. Weber's excellent paper elsewhere in this issue about what an electrical contractor should know, most contractors will think that if they knew all these things there would be no need of their continuing to work. This super-contractor should have all the qualifications of an electrical inspector, an architect, a supply salesman, an electrical engineer, and then some. "And still the wonder grew that one small head could carry all he knew."

Yet, upon analysis, it is apparent that an electrical contractor should strive to be familiar with all these diversified branches if he expects to take his place among the contractors of the future. Contractors realize that their present low business standard is largely due to the difficulty of a business man managing a trade demanding the specialized knowledge of an artisan, or to an artisan conducting a business requiring a broad understanding of trade conditions.

Consequently it behooves them to take advantage of every opportunity to learn more. They should get together in associations, they should read and discuss papers in the trade and technical press, they should study the new books and the new methods and do all in their power to keep abreast of progress.

A great business can be built only in the spirit of striving for perfection. It is necessary that certain ideals be set by the leaders in the electrical industry for the contractors to follow. Ignorance among contractors is partly the fault of the jobbers, manufacturers and central stations. The contractor is the man who comes most closely in contact with the consumer and it is to the direct interest of every branch of the industry that he be taught those things which will increase his efficiency and thus advance the industry as a whole.

Courtesy

Courtesy is the intangible element which gives value to service from any public utility corporation, be it electric railway, telephone, gas or electric company. It is a faculty which every employe and official should cultivate, particularly those who come in contact with the public. Courtesy has been defined as a combination of good manners, cheerfulness, patience and self-control. It is likewise the combination which unlocks the door to public confidence.

Courtesy is civilized civility, politeness originating in kindliness and expressed habitually. Common civility is expected, uncommon courtesy is unexpected, and the lasting impression is always made by the uncommon and the unexpected. Politeness, literally polished, implies a high regard for the opinions and feelings of others. The great majority of complaints about service are founded on misunderstandings and their satisfactory correction depends more upon the manner in which the explanation is made than upon the explanation itself.

Courtesy is the chief ingredient in tact, that indefinable sense of touch with regard to human character. It lubricates the little frictions of business so that the machinery runs smoothly and efficiently. Like a muscle, it is strengthened by use, and, conversely, is weakened by non-use. It should always be exercised in the thought that "a soft answer turneth away wrath." Courtesy is preeminently a characteristic which can be acquired. Even the individual who is not naturally courteous can learn to be considerate of others. Acquired courtesy, unlike many other acquired qualities, becomes the owner admirably. If used in the proper spirit it always appears natural—a sort of second nature of the individual.

The whole of ancient heraldry and chivalry is summed up in modern courtesy. Whereas, two hundred years ago a knowledge of heraldry, the science that treats of armorial bearings, formed an important part of the education of every gentleman, today the successful servant of the public knows that it is only with courtesy as his coat of arms that he can gain the friendship and esteem of those in the democratic court of public opinion.

These suggestions apply as well to the salesman and the engineer in every part of the electrical business. It is a lesson that all should learn and apply at every opportunity for intercourse with our fellow beings, if for no other reason than that courtesy begets good will and good will begets business. "Don't be curt—be courteous."

PERSONALS

C. V. Schneider, Sacramento contractor, spent a few days at San Francisco during the week.

Fred Strobel, of Moscow, Idaho, has been elected manager of the Moscow Telephone Company.

Geo. E. Battee recently resigned as salesman with the Electric Agencies Company of San Francisco.

C. A. Hunt, of the Hunt Electric Company, Santa Cruz, was a visitor at San Francisco during the week.

H. B. Squires, of the H. B. Squires Co., San Francisco, left the latter part of last week for a business trip to Chicago.

H. H. Medcroft, of the Anderson Electric Company, Anderson, Cal., spent several days at San Francisco during the week.

A. J. Myers, Pacific Coast manager Wagner Electric & Manufacturing Company has return to San Francisco from St. Louis.

G. A. Sherman, stores manager of the Western Electric Company, San Francisco, returned the first of the week from a trip to Seattle.

E. W. Newcomb, representative of the primary battery department of the Thos. A. Edison Co., at San Francisco, is on a trip to Salt Lake City.

W. S. Greenfield, manager of the H. W. Johns-Manville Co., San Francisco, recently spent a week on a business trip through Southern California.

Paul Lebenbaum, electrical engineer for the Portland, Eugene & Eastern Railway, has returned to Portland from a brief visit to San Francisco.

H. P. Treat, formerly with the Western Electric Company, New York, has been appointed assistant stores manager of that company at San Francisco.

Walter M. Evans has resigned as deputy electrical inspector at Portland, Ore., to accept a position with the federal government at Washington, D. C.

D. E. Ritchie, Mayor of Valdez, Alaska, was a recent Seattle visitor, making arrangements for the installation of a complete municipal electrical lighting system.

Henry A. Campbell, consulting engineer for the San Francisco Chamber of Commerce, has opened offices as consulting engineer in the Merchants' Exchange Building, San Francisco.

K. E. Van Kuran has recently been elevated to the position of district manager for the Southwestern District of the Westinghouse Electric & Manufacturing Company, with headquarters at Los Angeles.

Bertram Smith, of the sales department of Edison Storage Battery Supply Company, San Francisco, left the first of the week on a several weeks' trip to Ogden, Salt Lake City, Spokane and the North Pacific Coast.

W. A. Brackenridge, vice-president and general manager of the Southern California Edison Company, and **S. M. Kennedy,** general agent, were at San Francisco during the past week on business connected with the Railroad Commission.

Chas. W. Yerger, formerly in charge of the Los Angeles office of H. B. Squires Co., Pacific Coast representative of the Cutler-Hammer Manufacturing Company, has been placed in charge of the Cincinnati office of the Cutler-Hammer Manufacturing Company.

R. C. Coffy, treasurer of the Tacoma Gas Company, assumed management of the Everett Gas Company, Everett, Washington, March 15th, having been appointed to this position upon the resignation of **D. C. Green,** who goes to Salt Lake City. Mr. Coffy has been in the service of H. M. Byllesby & Company for seven years, having served the Oklahoma Gas & Electric Company prior to his connection at Tacoma.

J. S. Lapp, secretary of the Locke Insulator Company, Victor, N. Y., and **W. T. Goddart,** president of the Canadian Porcelain Company at Hamilton, Ontario, were arrivals at San Francisco during the week. The gentlemen are making a trip over the Pacific Coast, looking into business conditions in general. Mr. Lapp speaks encouragingly of business conditions in the East and the outlook for the West. He expects to visit Los Angeles and the southern territory on his way home.

MEETING NOTICES.

Alameda County Electrical Development League.

The Alameda County Electrical Development League will hold its next meeting at Key Route Inn, Saturday, March 27th, and will be known as Jovian Day. All Jovians and electrical men are welcome. Meeting will start promptly at 1:15 P. M.

San Francisco A. I. E. E. Section.

The regular monthly meeting of the San Francisco Section of the American Institute of Electrical Engineers will be held at the Engineers' Club, Hotel Sutter, March 26, 1915, 8 P. M. Mr. Romaine Myers will present a paper on "Electro-Chemical Possibilities of the Pacific Coast."

Electrical Development and Jovian League.

The March 10th meeting of the Electrical Development and Jovian League was devoted to an interesting talk by C. L. Cory, professor of electrical and mechanical engineering at the University of California. Prof. Cory took as his subject Michael Faraday and traced the influence which had been exerted by his discoveries on the marvellous electrical development of the present day. Faraday was born in 1791, died in 1867, and in this period made many notable contributions to scientific progress, including particularly the discovery of magneto-electricity, which made the transformer possible. Prof. Cory and C. E. Wiggin, chairman of the day, were accorded a hearty vote of thanks.

Oregon Society Engineers.

The regular monthly meeting of the Oregon Society of Engineers was held in the main dining room of the Portland Commercial Club, Thursday evening, March 11th. Mr. Howard Lee, M. E. of the Research Department of the American Rolling Mill Company, gave an illustrated lecture on the "Methods and Processes of Pure Iron Manufacture." His lecture covered the history of the development of pure iron—that is 99.85 per cent pure—and he went into the details of the present process used by the American Rolling Mills Company in making their "American ingot iron." He also pointed out the extensive use "pure iron" had been put to in the last eight years, as pure iron stands corrosion in nearly every instance better than steel.

The Portland Jovian League.

The regular Jovian League luncheon was held at the hotel Burson, Friday, March 12th. Senator Huston made an address on "Hydroelectric Measures." Mr. Huston said, "that the various bills presented in the recent session of Congress for the regulation of the use of water power did not tend toward conservation, but rather toward prohibition." He showed that the East was interested in preventing the development of water power with its accompanying manufacturing industries in the West, because of the fact that at present the large manufacturing centers of that section were furnishing the West." Mr. W. S. Turner, president of the Oregon Society of Engineers, was chairman of the day. The Oregon Society of Engineers will combine their luncheons in the future with the Portland Jovian League.

Los Angeles Electric Vehicle Association.

The regular monthly meeting of the Los Angeles Section of the Electric Vehicle Association of America was held at the Jonathan Club March 9th, with an attendance of 29 members and three guests, Chairman J. Harry Pieper presiding. The first paper of the evening was one prepared by A. Jackson Marshall, executive secretary, entitled "Electric Taxicab," which was read by Harry Mason of the Chanslor & Lyon Co.

H. J. Kister, new business manager of the Los Angeles Gas & Electric Corporation, read the paper prepared by Mr. Wm. P. Kennedy on "The Progress of Electric Vehicles." This paper proved most interesting, and speaks well for the future of the electric vehicle. The chairman of the membership committee reported that he will have three applications for membership at the April meeting. J. O. Case, chairman of the garage committee, reported progress in the matter of a new schedule of prices for the charging of electric vehicles, which they expect to have in effect very shortly. Chairman J. Harry Pieper made a short talk on the advisability of all the members co-operating in conducting an electric page in the papers at least once a week, and appointed as chairman of the committee to investigate R. R. Thomas, with the following members to assist him: Messrs. Starret, Wilder, Beardsley and A. T. Smith, the committee to report at the April meeting. E. H. Mulligan, district agent at Pasadena, Cal., for the Southern California Edison Company, gave an interesting talk on his experiences with the first electric pleasure car that the company owned.

Jovian Electrical League of Southern California.

An interesting program was provided for the members of the league, who gathered 125 strong, for their weekly luncheon at Christopher's on March 10th. Among the guests who were introduced were Clark Baker, Pacific Coast manager of the National Lamp Works, from Oakland; Ross Mateer, of the Southern Sierras Power Company, from Riverside; Bert Whitham, electrical engineer from Mexico, and Curt Mansfield, a well-known German chemist, now located in Los Angeles. The new identification badges were distributed, and their artistic merit won high praise from the members.

The chairman of the day, Irving Ross Soloman, introduced Nelson and Elsie Story, who entertained the guests with a number of catchy songs and piano solos. There were three-minute talks by H. H. Fogwell, on H. Jack Moulton, and E. L. Nightingale, on Carl D. Benz. The speaker of the day was Archie J. Eley, chief of the Los Angeles Fire Department, who spoke on "Electrical Fire Hazards." He advocated the passing of the following ordinance now before the City Council: "All wires hereafter installed in or on all buildings or other structures in the City of Los Angeles, as the same are now or may hereafter be defined in the building law of the City of Los Angeles, and used for the purpose of conducting electricity, shall be enclosed in conduits or armored cables." The chief gave his reasons for this and other recommendations, which will be printed in a future issue, and asked the support of the league in the interest of all measures intended to better the local wiring situation, and Tribune Pieper assured the chief of such co-operation.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Pacific Gas & Electric Company has filed an application with the commission requesting authority to issue and place in the sinking fund provided under its general and refunding mortgage, dated December 1, 1911, $367,000 of its general and refunding mortgage gold bonds.

The Western Union Telegraph Company has filed an application with the commission, requesting authority to sell the telegraph line between Sonora and Columbia, Tuolumne County, to Thomas Conlin, for the sum of $1.

The Oakland, Antioch & Eastern Railway has filed an application with the commission, requesting authority to renew the following promissory notes: Union Trust Company of San Francisco, $100,400; Anglo & London Paris National Bank, $93,000; A. W. Maltby, $7,000. It is proposed to secure these notes by the delivery of bonds on the basis of 60 per cent of their face value. The company also asks for authority to secure a note heretofore issued to Union Switch & Signal Company in the sum of $21,028.77 by the delivery of bonds on the same basis.

The Oro Electric Corporation has filed an application with the commission, requesting authority to hypothecate 180 first mortgage six per cent sinking fund gold bonds, in order to secure the sum of $60,000, which it proposes to borrow for a period of one year, with interest at 7 per cent.

The commission has issued a supplemental order authorizing the Oceanside Electric & Gas Company to issue $12,442 of promissory notes to parties other than those named in the original order of the commission, dated February 24, 1915.

C. M. Kirby, owner of certain telephone property at Dixon, Solano County, has filed an application with the commission, requesting authority to transfer his interest therein to The Pacific Telephone & Telegraph Company for the sum of $500.

The commission has issued an order authorizing the Coast Counties Gas & Electric Company to renew a note in favor of John A. Roeblings Sons Company for the sum of $4,468.66.

The commission has issued an order authorizing the Southern California Edison Company, operating in Kern, Santa Barbara, Ventura, Los Angeles, Orange, Riverside and San Bernardino counties, to issue $2,500,000 of five year 6 per cent debentures, at not less than 95 and accrued interest. The company is also authorized to issue 27,500 shares of common capital stock, for the purpose of taking up or refunding $2,500,000 of debentures on the basis of 11 shares of stock for one debenture of the face value of $1000.

The City Electric Company has filed an application with the commission, requesting authority to amend its first mortgage and deed of trust, dated July 1, 1907, securing bonds to the extent of $5,000,000, so that the security behind the bonds will be strengthened.

PUBLIC UTILITY COMMISSION FOR UTAH.

A bill providing for the creation of the public utilities commission has been presented before the 1915 session of the Utah State Legislature and is now before the judiciary committee for consideration. Several public hearings have been held and many have appeared before the committee both for and against the bill. It is urged by its proponents that Utah and Wyoming are the only two states in the Union which do not have such a commission, and that the growth of the public service corporations within the state has reached a point where regulation is necessary in order to provide for fair dealings between the companies and their patrons. The opponents of the measure urge that the state still possesses great natural resources which should be developed, and that it would be unwise and inexpedient at this time to place measures on these statute books which would in any way retard the development of these resources by imposing restrictions on them.

NEWS OF IDAHO PUBLIC SERVICE COMMISSION.

The Idaho-Oregon Light & Power Company, the Idaho Railway, Light & Power Company and the Idaho Power & Light Company have been ordered to file with the commission, on or before the 8th day of May, 1915, to become effective on the 15th day of May, 1915, a schedule or schedules setting forth the rates which the companies propose to charge for furnishing electrical energy for operating motors exceeding the rated capacity of 15 h.p., as well as copies of all contracts, either verbal or oral, which are now in effect under the terms of which the companies are required to furnish electrical energy for operating motors in excess of 15 h.p. rated capacity.

The Idaho Power & Light Company has been ordered to file with the commission a full and complete schedule of rates for residential and commercial lighting and domestic cooking for the towns of Shoshone, Filer, Twin Falls and all other towns in said territory for which schedules are not now on file, as well as the schedule of rates for commercial cooking, power and heating purposes in the towns of Glenns Ferry,

Mountain Home, Gooding, Shoshone, Buhl, Filer and Twin Falls, and all other towns and villages in said territory. The company has been ordered to refrain from soliciting or contracting for electrical energy for commercial cooking and power purposes in excess of 15 h.p. of connected load, until such time as the schedules of rates have been filed.

INTERNATIONAL ENGINEERING CONGRESS.

W. A. Cattell, secretary of the International Engineering Congress to be held at San Francisco, September 20-25, 1915, announces that manuscript is being rapidly received for the transactions, which will make from seven to nine volumes. The first volume will deal with the Panama Canal. Volume II will comprise two series of papers. one on the subject of Waterways and one on Irrigation. The former subject will be treated under four general topics with possibly two additional if authors are found in sufficient time. These topics cover the general field of the province of waterways in internal commerce, economic aspects, physical features, natural waterways, towage and propulsion. The subject of irrigation will be treated under 11 topics covering: Methods of handling irrigation enterprises; duty of water; relation between demand and supply; underground sources; stream sources; tail water from hydroelectric plants; regulations for use; methods of charge; metering; drainage; dams in general; and also recent developments in India and in the Argentine Republic. In both of these general subjects authors have been obtained representing practice abroad as well as in the United States. This is especially the case with the general subject of irrigation, where an effort has been made to obtain representative writers from the leading foreign countries in which irrigation plays an important part. This volume as a whole will comprise from 20 to 25 original papers, profusely illustrated with charts, diagrams and half tones, together with discussions contributed by leading American and foreign engineers, and will form a most valuable acquisition to the library of all engineers and others who may be interested in these phases of engineering work.

ELECTRICAL CODE ADOPTED AT PORTLAND.

The Portland City Council has passed the new electrical code drafted by a committee representing the electrical interests, the fire underwriters and the electrical workers' unions, The ordinances, as passed, changes working conditions radically and is expected, in many cases, to increase wiring costs because of the fact that only registered contractors who pay a license of $25 a year are to be permitted to do contracting. Exception to this rule is made only in the case of property owners, who are permitted under the ordinance to do wiring on their own premises.

Every electrical contractor, whether an individual or a firm, must pay a license fee of $25 a year. Every contracting firm must have as a member a supervising electrician, and every individual who does contracting by himself must be a supervising electrician. All work must be done under the direction of the supervising electrician.

The ordinance provides that every electrician who shall qualify as a wireman to have supervision of work must present an affidavit showing that he has had at least four years' experience and is more than 21 years of age. The electrical inspector has power to grant or refuse him the privilege of working.

The purpose of the part of the ordinance pertaining to working conditions is said by Electrical Inspector Dunlap to be to eliminate boys and inexperienced and unreliable workmen from the field. Mr. Dunlap says this is necessary in spite of the fact that the city, under the new ordinance, requires the inspection and approval of every job of wiring before electricity is furnished by the electrical companies, and makes a charge of 50 cents for each inspection of work after the first two.

A board of appeals consisting of three members is provided for. The members are to be appointed by the mayor and each will serve three years. All controversies between contractors and the electrical inspectors will be settled by this board. In making an appeal a contractor must put up a deposit of $10, which will be refunded if he wins his appeal or will be confiscated if the city wins.

The measure makes a reduction in some of the permit fees. The fixture fee at present is 5 cents for each socket. This is reduced to 3 cents. For electrical decorations on the outside of buildings $1 is to be charged for the first 50 lamps, and 1 cent for each additional lamp. The old rate was 5 cents for each lamp. For motor or generator installation permits the old rate was 10 cents for each horsepower. The new rate ranges from 50 cents to $2.50 for a permit.

TRADE NOTES.

The California Ripe Olive Association has set aside March 31st to be observed as "Olive Day."

The Claggett Electric Company is installing a conduit system in the Lewis Building, Portland.

W. A. Kraner & Company are doing the remodeling of the electric system in the Rosenthal & Company's store at Portland.

The Morrison Electric Company is replacing the portion of the electric wiring which was damaged by fire in the Shea Bros. building, Portland.

"The Light House" has the electrical contract for the rewiring of the Wilson Estate Building, Portland. This is a complete conduit system.

Negotiations tending to a more complete and thorough distribution and marketing of Holophane products on the Pacific Slope and announcement of the completed arrangement is anticipated in the near future.

The J. C. English Company has the contract to install the lighting fixtures in the new dining room of the Imperial Hotel, Portland, and the Morrison Electric Company installed a complete iron conduit system in same.

The Portland Railway, Light & Power Company has a contract from the Tacoma Dredging Company for furnishing power to manufacture 1,000,000 cu. yd. of material to be used to build the approaches to the new Columbia River Interstate Bridge. There will be 1000 kw. used on the dredge and 800 h.p. on a booster pump. The dredging company takes the contract for 15 cents per cu. yd.

The Westinghouse Lamp Company have just standardized 25, 40 and 60 watt Westinghouse Mazda lamps with a concentrated coiled filament construction similar to that used in the large gas-filled Mazda C lamps. The small lamps are, however, not gas filled, but of the usual vacuum type. The new filament construction greatly increases the downward or useful light of the lamps, which makes them particularly desirable for service where natural distribution in the downward direction is required. They are supplied in the usual bulbs, 25 and 40 watt sizes in S-19 and 60 watt in S-21 for 105 to 125 volts. Their rated life is 600 hours.

The distinctive features of the concentrated filament Mazda lamps of high wattages have proved so popular that the Edison Lamp Works of the General Electric Company has developed vacuum Mazda lamps of similar appearance in the 25, 40 and 60 watt sizes. This concentrated filament construction gives greater vertical distribution of light than the regular Mazda lamps of corresponding wattages. The new lamps will, therefore, be employed where natural distribution of light downward is required. They can be used in existing sockets and fixtures. These lamps will be made in the same sized bulbs as the corresponding regular Mazda lamps, will have the same spherical watts per candlepower efficiency and will have a rated average life of 600 hours.

NEWS NOTES

ILLUMINATION.

REEDLEY, CAL.—The Parlier Winery Company has been granted a gas franchise here.

BILLINGS, MONT.—Parties who have purchased the Billings Gas Company plan extensive improvements and erection of a 150,000 foot tank.

SILVER CITY, N. M.—A new lighting system is to be installed at cost of about $3000. Iron standards surmounted by cluster of lights will be used.

SUSANVILLE, CAL.—The city board of trustees has accepted the bid of H. Howard Dunbar for a franchise to operate a gas plant in this city.

RIVERSIDE, CAL.—Petitions for a lighting district for the east side will be presented to the council at an early date. The cost of the proposed system is about $20,000.

LOS ANGELES, CAL.—The board of supervisors has adopted a resolution calling an election to be held March 27th for the formation of the Be'vedere Lighting District.

MARTINEZ, CAL.—It is going to cost $26,418 to install a pressure station in Martinez and a distributing system in the city according to figures of the Contra Costa Gas Company.

SAN ANSELMO, CAL.—Messrs. Lamphere and Breck of Yolanda court addressed the board that the lighting was insufficient. They said the residents would erect proper electroliers if the city would light them.

GOLD HILL, ORE.—Bids will be received until April 7th for the installation of a street lighting system, and furnishing electric current for a period of 10 years, according to plans and specifications on file in the office of the City Recorder.

LOS ANGELES, CAL.—Ordinances of intention have been adopted by the council for the installation of ornamental lighting posts on North Main street, between Sunset Boulevard and First street, and Main street, from First to Pico street, and and many other streets, to be maintained and electric current furnished for a period of one year, beginning July 1, 1915.

TRANSMISSION.

ESCONDIDO, CAL.—The board of supervisors has granted a franchise to the Escondido Mutual Water Company to build a power line from its dam into the city of Escondido.

WINONA, WASH.—M. C. Osborn of the Washington Water Power Company proposes to extend its power line from Endicott to Winona and La Crosse if satisfactory terms can be made.

VALE, ORE.—Paul Davis, representative of the Idaho Power & Light Company, states that construction work will start on the power line within a few days from Caldwell to Weiser through Nyssa.

TACOMA, WASH.—The Mutual Electric Light & Power Company of Riverside, composed of Puyallup valley farmers, has applied for a franchise to erect poles along the King county line to enable Puyallup valley farmers to get current for light and power purposes.

OAKLAND, CAL.—That the Central Oakland Light & Power Company is to be absorbed by the Great Western Power Company was a rumor in financial circles last week. The former concern operates in Oakland, supplying light and power. Details of the transaction were not made known, but it was rumored that it was an outright sale. The sale would give to the Great Western Power Company considerable advantage in having a ready installed distributing system in this city.

TRANSPORTATION.

SAN FRANCISCO, CAL.—Bids are being taken for the construction of the Beach terminal loop for the Geary street municipal railway.

LOS ANGELES, CAL.—The Los Angeles & San Diego Beach Railways Company will shortly put into service a number of motor cars, locomotives and trailer cars, to be utilized for service during the exposition at San Diego.

SACRAMENTO, CAL.—A. F. Shartel, Assemblyman from Alturas, has introduced a resolution asking that the State Highway Commission be directed to investigate and report on the cost to the state of acquiring and extending existing electric interurban lines.

OREGON CITY, ORE.—The Willamette Valley Southern is a 32-mile interurban line recently put in service between Oregon City and Molalla, Ore. Current is supplied to substation at Beaver Creek and Monitor from the river mill plant of the Portland Railway, Light & Power Company, the trolley voltage being 1200 volts.

CLARKSTON, WASH.—A. G. Nortz, head of the company which will provide transportation for Lewiston Clarkston valley, has announced that construction work on the street railway system will start at once. The contract for building the line across Snake River has been awarded to Edward McGarry, Lewiston, and work will commence at once.

SAN FRANCISCO, CAL.—President Jesse W. Lilienthal has agreed with representatives of the city to a transfer arrangement between the municipal Stockton street line and the United Railroads Fourth street line at Ellis and Market streets to the Third and Townsend street depot. This will give the municipal system a direct transfer arrangement to the Third and Townsend street depot to and from the Exposition.

SAN FRANCISCO, CAL.—The city engineer reports that the estimate of the cost of constructing the Municipal Railway on Stockton street and Columbus avenue, and through the Fort Mason reservation has been exceeded. He has presented claims for extra work which are being adjusted. When the contract was awarded last November the cost was figured at $125,773, according to Rolandi's rates and the specifications, but it has amounted to $128,538. Rolandi also is entitled to a bonus of $9000 for quick work.

TELEPHONE AND TELEGRAPH.

WAITSBURG, WASH.—An ordinance has been adopted by the council granting to the Waitsburg Rural Telephone Company a franchise to operate in the streets and alleys of the city.

LOS ANGELES, CAL.—The city council has issued a peremptory order to the two telephone companies that one of them go out of business or lose its identity through absorption by the other. The council also decided to take a straw vote of the people, probably at the coming primaries to ascertain if the public desires one telephone system. A resolution calling for this election, to ascertain public sentiment, is now being prepared.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company at its annual meeting elected the following directors and officers: Directors—H. T. Scott (chairman), J. C. Ainsworth, E. C. Bradley, J. C. Cebrian, Wm. H. Crocker, F. G. Drum, F. W. Eaton, M. Ehrman, George D. Greenwood, Timothy Hopkins, H. S. King, G. E. McFarland, W. S. Martin, H. D. Pillsbury, J. M. Quay, Theodore N. Vail and O. J. Woodward. Officers—G. E. McFarland, president; H. D. Pillsbury and J. M. Quay, vice-presidents; F. W. Eaton, secretary and treasurer; J. C. Nowell, general manager; F. C. Phelps, general auditor.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 **American Ever-Ready Works of National Carbon Co.**
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-2 **Benjamin Electric Manufacturing Co.**
Rialto Bldg., San Francisco.

B-3 **Blake Signal and Manufacturing Co.**
680 Howard Street, San Francisco.

B-5 **Bridgeport Brass Co.** 3
(See Pierson, Roeding & Co.)

B-6 **Berkeley Electric Cooker Co.**
1932 Center Street, Berkeley.

B 7 **Busch-Sulzer Bros.-Diesel Engine Co.** 2
Rialto Bldg., San Francisco.

C-1 **Century Electric Co.** 12
614 South Grand Avenue, Los Angeles; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-4 **Cutler-Hammer Manufacturing Co.**
579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 **D. & W. Fuse Co.**
Western Electric Co.

D-2 **Dearborn Drug and Chemical Works.** 3
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 **Edison Lamp Works of General Electric Co.**
Rialto Bldg., San Francisco.

E-2 **Edison Storage Battery Supply Co.** 4
441 Golden Gate Avenue, San Francisco.

E-3 **Electric Agencies Co.**
247 Minna Street, San Francisco; Central Building, Los Angeles.

E-4 **Electric Storage Battery Co.**
Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; 118 New Montgomery Street, San Francisco; Colman Bldg., Seattle.

F-1 **Fairbanks, Morse & Co.** 3
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 **Fort Wayne Electric Works of G. E. Co.**
Rialto Bldg., San Francisco; Colman Bldg., Seattle.

G-1 **General Electric Co.** 5-10
124 W. Fourth Street, Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

H-1 **Habirshaw Wire Co.** 12
(See Western Electric Company.)

H-2 **Hemingray Glass Co.** 3
330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-5 **Hunt, Mirk & Co.** 6
141 Second Street, San Francisco.

H-6 **Hubbard & Co.**
Rialto Bldg., San Francisco.

I-1 **Indiana Rubber and Insulated Wire Co.**
Fobes Supply Co., Portland and Seattle.

K-1 **Kellogg Switchboard and Supply Co.**
Aronson Bldg., San Francisco.

K-4 **K-P-F Electric Co.**
37 Stevenson Street, San Francisco.

L-1 **Leahy Manufacturing Co.**
Eighth and Alameda Street, Los Angeles.

L-2 **Locke Insulator Manufacturing Co.** 4
(See Pierson, Roeding & Co.)

M-2 **McGlauflin Manufacturing Co.**
Sunnyvale, Cal.

M-4 **Morse Chain Co.**
Monadnock Bldg., San Francisco.

M-3 **Moore & Co., Charles C.** 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 **Nason & Co., R. N.**
151 Potrero Avenue, San Francisco.

N-2 **National Conduit & Cable Co., The.**
Trust and Savings Bldg., Los Angeels; Rialto Bldg., San Francisco.

N-3 **National Lamp Works of G. E. Co.**
(All Jobbers.)

N-4 **New York Insulated Wire Co.**
629 Howard Street, San Francisco.

O-1 **Okonite Co. (The)** 12
(All Jobbers.)

P-1 **Pacific Electric Manufacturing Co.**
80 Tehama Street, San Francisco.

P-2 **Pacific States Electric Co.** 2
236-240 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 200-210 12th Street, Oakland; 575 Mission Street, San Francisco; 307 First Avenue, So., Seattle.

P-4 **Pelton Water Wheel Co.** 4
2219 Harrison Street, San Francisco.

P-5 **Pierson, Roeding & Co.** 4
Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-7 **Pittsburgh Piping & Equipment Co.** 12
Monadnock Bldg., San Francisco.

S-1 **Schaw-Batcher Company, Pipe Works, The.**
211 J Street, Sacramento; 356 Market Street, San Francisco.

S-2 **Simonds Machinery Co.**
117-19-21 New Montgomery Street, San Francisco.

S-3 **Simplex Electric Heating Co.** 12
612 Howard Street, San Francisco.

S-4 **Southern Pacific Co.** 3
Flood Bldg., San Francisco.

S-5 **Sprague Electric Works.**
Rialto Bldg, San Francisco; Colman Bldg.; Seattle; 124 West 4th Street, Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 **Standard Underground Cable Co.** 2
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland; Central Bldg., Seattle, Wash.

T-1 **Thomas & Co., R.**
(See Western Electric Co.)

W-1 **Wagner Electric Manufacturing Co.** 2
Rialto Bldg., San Francisco.

W-2 **Western Electric Co.**
8th and Santee Streets, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 907 First Avenue, Seattle; 45 North Fifth Street, Portland, Ore.

W-4 **Westinghouse Electric and Manufacturing Co.**
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Second and Cherry Streets, Seattle; Paulsen Bldg., Spokane.

W-5 **Westinghouse Machine Co.** 6
141 Second Street, San Francisco.

W-6 **Westinghouse Lamp Co.**
(See Westinghouse Electric and Manufacturing Co.)

W-8 **Western Pipe & Steel Co.**
444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.